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Electrical Development in Rural Areas.

DESPITE the risk of appearing to labour the subject unduly, we must again refer to the supply of electricity in rural areas, in order to express our gratification at the issue of a Memorandum with the title quoted above, by the Electricity Commissioners. In view of the importance of this document, we print it in full elsewhere in this issue.

Its importance is of a two-fold nature. In the first place, it is in itself an instrument of great potency to effect improvement in the conditions which obtain, by placing before local authorities, landowners, occupiers, and the public generally the facts regarding their respective rights and duties, the powers conferred upon the Electricity Commissioners by Parliament, and the nature of electricity supply as a public utility service; and secondly, its whole tenor indicates that the Commissioners are abandoning the somewhat passive policy which they seem to have pursued in the past with regard to the extension of electricity supply into rural areas and are going to take a hand in the matter themselves. We heartily welcome their intervention and trust that their activity will be maintained and increased; this first Memorandum is admirable both in matter and in manner, and will go far to dispel some of the mistaken ideas which have hampered progress—but it is only a beginning. As the Commissioners themselves indicate, the issue of an official model form of wayleave agreement would afford further assistance, and other means of hastening development can be devised.

It will be remembered that in the discussion on Mr. W. C. Bexon's paper on "Distribution over an Extensive Area," before the I.M.E.A. last June, Capt. J. M. Donaldson, M.C., suggested that the Ministry of Transport might issue a document explaining various points with regard to overhead lines, and a form of consent which would free supply undertakings from heavy legal

charges; his suggestions appear to have borne fruit, and thanks are due to him for so useful and timely a proposal.

Whilst the Electricity Commissioners in some respects occupy a judicial position—for instance, in the determination of Electricity Districts, where they act impartially as between one electricity authority and another—it would be a disastrous mistake to suppose that they are called upon to act as judges in all cases. By Act of Parliament the duty is laid upon them in the first line of the first Section of the Act of 1919 by which they were called into existence, of *promoting* the supply of electricity: they are not judges but *advocates*, and it is up to them to see that no effort is spared to develop the supply of electricity in all parts of the country. The Postmaster-General stands behind his officers and backs them up; similarly we look to the Commissioners to support the engineers who are carrying out their work and to exert their influence, through the Minister of Transport, with firmness and decision. We welcome this Memorandum as evidence of their intention to act with vigour and initiative, and we shall look forward hopefully to their further activity in this sense.

E.A.M.A.

THE objects of the Electrical Accessories Manufacturers' Association which, as stated in our last issue, is widening its scope, are to encourage the sale of electrical accessories of British manufacture; to make a study of economic production and distribution; to associate and co-operate with bodies already named by us; and to collect commercial and technical data for distribution among E.A.M.A. members. In these days of organisation of individual sections of the industry for the purpose of efficiently co-operating with others, it is felt that with a more representative membership, greater progress can be made than in the past. We recommend eligible electrical accessories manufacturers who have not so far identified themselves with the movement to give it careful attention. In order to do so they would do well to place themselves in touch with Mr. F. J. Collis, the Secretary, at 39, St. James's Street, S.W., who doubtless will be prepared to forward printed details on receipt of application.

The British Association.

THE annual meeting of the British Association for the Advancement of Science opened at Leeds on Wednesday evening with the delivery of his address by the President, Sir Arthur Keith, F.R.S. Owing to the fact that the papers which are of interest to our readers will not be presented until the latter part of the meeting, next week, we are unable to deal with them in this issue, but hope to reproduce them in abstract form later. These include notable contributions by Messrs. H. W. Clothier, P. Dunsheath, and R. Borlase Matthews upon the subjects in which they specialise, namely, switchgear, cables, and electricity on the farm (the transport aspect).. This is the third time that the British Association has met in Leeds, the last occasion being in 1890, under the presidency of Sir Frederick Abel. The presidential address then took the form of a review of electrical progress between the date of the first Leeds meeting (1858) and 1890. Sir Frederick noted then that nine companies were, or shortly would be, supplying electricity in the western part of London, and that there were 27 other central stations at work in the provinces. Three miles of electric railway was to be opened in London shortly; and there were 99,000 telephones in use. The commencement of electric welding and the development of electric furnaces and the necessary generators were among the other matters mentioned. Mr. Wilson Hartnell read a paper on "Electric Lighting and Fire Insurance Rules"—a subject which still possesses the same amount of interest. One statement made is worth quoting: "Much is left to the conscience or ability of the contractor, which is unjust to those who abide by the best rules." Other papers dealt with the effects of a.c. and d.c. on the human body (a subject still far from definite conclusions); the character of steel used for permanent magnets, by W. H. Preece, F.R.S.; "On the Form of Submarine Cables for Long-Distance Telephony" by the same author, delivered just prior to the opening of the London-Paris route; the specific resistance of copper; the absolute resistance of mercury (in relation to the definition of the ohm); the molecular theory of induced magnetism; and Sir Wm. Thomson's (Lord Kelvin's) new electricity meter. Altogether there were 26 papers of an electrical or kindred nature; at this year's meeting there are only about half-a-dozen, neglecting the purely physical contributions in Section A.—Mathematics and Physics. This certainly indicates that electrical science is out of its "infancy," and that its character is more or less moulded.

The Dating of Patents.

ON another page we print a summary of the conclusions of the Committee which has been considering the question of altering the system of dating patents, in order that the British system might be brought more into accord with that of other countries. It is difficult to see how anybody who knows the facts can be of opinion that inventors in foreign countries are being treated in any way unjustly here. A foreign applicant in this country has priority from the date of his foreign application, and no rights of other parties arising here after that date and before the date of his application here can interfere with his patent rights. On the other hand, when a British inventor takes out a patent in a foreign country, though applying under the Convention, he has to contend against rights which have arisen after his application here and before his application in those countries. In some of them the patent is of no effect against persons who have already used the invention, or made arrangements for its use, before his application in those countries, even though such use, or arrangements for use, were after his application, and probably publication, here. This is not what was intended by the framers of Article 4 of the Convention of 1911. The Committee proposes an alteration in the British patent system—namely, that the fixed portion of the monopoly period should run from the date of the filing of the complete specification—in order to meet the wishes of other countries. This will do no harm to British inventors or the British public, but we agree with the Committee that the change should be made only as part of a bargain, and that the abolition of those third-party rights should be given in return.

The date between the original application and the date of the filing of the complete specification would then be added to the monopoly period in the case of both British and foreign applications, and would thus make it possible to secure a life of 17 years for the patent; but only 4½ per cent. of British patents ever reach the full term of life, and consequently this recommendation by the Committee of the Board of Trade has not the importance which it might appear to have. Until something is done to make it possible for a patentee, who is not well off, to enjoy the life of his patent for the present period of 16 years, the addition of a few months or even a year to the period does not convey much comfort to him. As we have pointed out before, every £1 extracted by the Treasury in the form of renewal fees probably represents a loss of thousands of pounds in ordinary income tax which might be secured if inventors were encouraged in this country instead of being taxed out of existence.

It is interesting to note that Prof. Sir James B. Henderson, in his presidential address to Section G.—Engineering—of the British Association, touches upon the "Difficulties of Invention," and commends certain features of the American system; unfortunately he does not discuss the financial difficulty, from which that system is free.

Electricity Supply at Sunderland.

Details of 20,000-kW generating-plant extensions and mains developments, which have cost £320,000 and will enable the station to carry a load of 15,000 kW.

THE Sunderland Corporation's electricity undertaking has made the biggest step forward in its 32 years' history by installing two new turbo-generators, with other machinery, and laying down upwards of 60 route miles of distributing mains, so that in practically every street in the borough a supply of electricity is now within the reach of every resident. To mark the inauguration of the extensions a tablet was unveiled at the main generating station on August 24th by Sir John F. C. Snell, chairman of the Electricity Commission, who was borough electrical engineer at Sunderland from 1896 to 1906.

Sunderland's electricity supply was inaugurated on March 6th, 1895, the system having been laid down under the advice of Professor (now Sir) Alexander B. W. Kennedy. The growth of the undertaking is indicated by the fact that last year the capital expenditure amounted to £1,202,000, the consumers numbered 7,067, and 23 million kWh of energy was sold. The main power house, fig. 1, now contains five turbo-alternator sets, the three installed some years ago being a 2,000-kW Willans-Dick Kerr set, a 6,000-kW set by the A.E.G., and a 5,000-kW set by the G.E.C. in conjunction with Willans & Robinson. The two latest sets were supplied by the General Electric Co., Ltd.; each, fig. 2, has a normal output of 12,500 kVA at 5,000 volts, 50 cycles, 3,000 r.p.m., with a power factor of 0.8 and a steam pressure of 240 lb. per sq. in. at 650 deg. F. Hitherto it has been the practice to expand the steam in the first stage of the turbine down to a comparatively low pressure, in order to keep the casings and packing glands steam-tight and prevent the casing reaching a dangerously high temperature. The tendency to use high steam pressures, however, involves the negotiation of a very considerable heat drop in the first stage, with the result that the efficiency of this stage is not all that could be desired. The Fraser & Chalmers Engineering Works has solved the problem in the following way:—The first stage is replaced by a number of stages of comparatively small diameter, each utilising a small heat drop only, so that the efficiency of this portion of the turbine is at least as good as that of the low-pressure stages. All the h.p. stages are in an internal casing, forming a h.p. turbine in themselves, placed in front of the remaining stages. The internal casing is surrounded by the main casing and fixed to the latter in such a way that it can freely expand in radial and axial directions, remaining at the same time concentric with the main turbine and correctly fixed in the longitudinal direction. The live steam is introduced directly into the internal turbine without coming into contact with the outer casing; from the internal h.p. turbine the steam is discharged into the main turbine at a moderate pressure and temperature and, since the internal casing is surrounded by steam of medium pressure and temperature, its condition (with regard to loading and temperature difference) is, in fact, more favourable than that of the outer casing.

A totally enclosed system of ventilation has been adopted for the alternators, the air being circulated by means of external fans through a surface cooler, the cooling medium being the condensate and boiler make-up feed water.

The condensing plant has to deal with 114,000 lb. of steam per hour and maintain a vacuum of 27¾ in. when supplied with cooling water at 80 deg. F., the cooling surface being 14,000 sq. ft. and the amount of cooling water required 672,000 gallons per hour; the Hick-Breguet "Ejectair" apparatus has a capacity of about 60 lb. of dry air per hour, and is operated by two steam jets in series with an intermediate condenser.

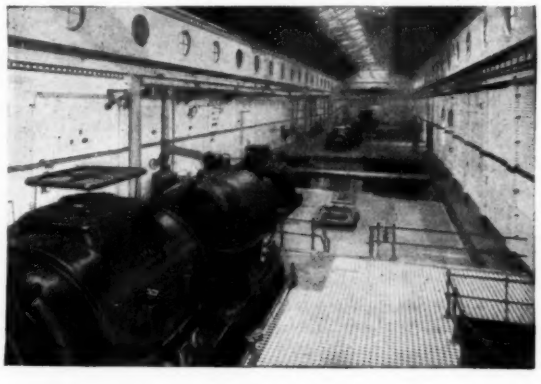


Fig. 1.—General View of Turbine Room.

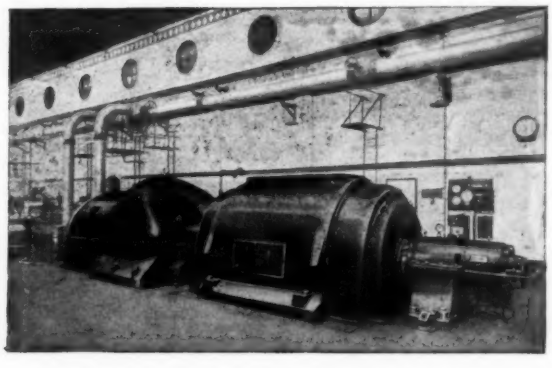


Fig. 2.—One of the two new 10,000-kW. G.E.C. Turbo-Alternators.

The boiler-house extensions consist of two separate boilers supplied by the Vickers Boiler Co., Ltd., each having a heating surface of 7,670 sq. ft., the steam pressure being 260 lb. per sq. in. and the superheat temperature 660 deg. F. The two chain-grates for each boiler were supplied by the Underfeed Stoker Co., Ltd., and the economisers by Messrs. E. Green & Sons; each boiler is fitted with separate induced-draught Davidson fans. Two turbine-driven boiler feed pumps, each of 15,000 gallons per hour capacity, were supplied by Messrs. J. P. Hall & Sons, Ltd., whilst an electrically driven rotary pump of 7,500 gallons per hour capacity was supplied by the British Electric Plant Co., and the Davenport Engineering Co., Ltd., supplied four wooden cooling towers of a total capacity of 650,000 gallons of water per hour. The treatment of the feed water, obtained from a well on the premises, is provided for by double-effect distilling plant by Messrs. P. & B. Evaporators, Ltd.

The high-voltage switchgear is housed in a separate two-storey building which forms an annexe to the engine room; it comprises nineteen stonework 5,000-

volt cubicles and also twenty-five steel-plate 5,000-volt cubicles which control distribution feeders. The whole of this apparatus was manufactured by the General Electric Co., Ltd. The oil circuit breakers are of the type V with a maximum breaking capacity of 250,000 kVA, and two long double breaks per pole.

The electrical control board, fig. 3, consists of slate panels on which are mounted indicating and integrating instruments, Merz-Price protective gear for the turbo-alternators (provision having been also made for main and exciter field control), and gear control for the turbine governor. Independent arrangements exist for separate excitation, if necessary. On each group-feeder panel there are indicating lamps which show the positions of the feeders comprising a group. On the ground floor of the switch house is a steel-cubicle board, fig. 4, for the control of the outgoing feeders; it is divided into five groups of five feeders each, and outgoing cables from the five main group-feeder cubicles on the first storey go direct to the bus-bars of the corresponding section of this steel-plate cubicle board, Pirelli-General cable boxes being employed. The steel-plate cubicles are divided into compartments by similar partitions in exactly the same way as the stone-work cubicles, with the exception than an extra compartment is situated behind the oil circuit-breaker compartment which contains isolating links for disconnecting the outgoing cables. The oil circuit breakers are of the type IV with a maximum breaking capacity each of 150,000 kVA.

Distribution mains are being laid throughout the Borough, where not already existing, and the street lamps converted to electric, which will entail laying upwards of sixty miles of medium-pressure distributing cables and the conversion of more than 1,400 street lamps. The cables are armoured and, where conditions allow, are laid direct in the ground; but where impurities in the soil are encountered they are being laid in wood troughs creosoted under pressure and filled in solid with pitch. With a view to future developments, the distributing cables employed are as large as possible, for the most part containing four cores each of 0.15 sq. in. section arranged to supply 220 volts for lighting and 380 volts for power and similar purposes. The contractors for the supply of the cables were the Pirelli-General Cable Works, Limited.

Eight public supply sub-stations have also been erected, each provided for the main part with two 250-kW transformers and arranged in three separate fireproof compartments, containing respectively the e.h.p. switchgear, the transformers, and the l.p. switchgear.

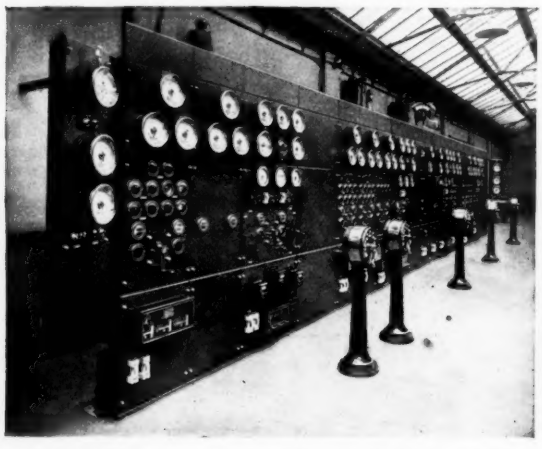


Fig. 3.—Electrical Remote Control Board for 5,000-Volt Switchgear.

Fig. 4.—Steel-Plate Cubicle Switchboard for Controlling Distribution Feeders.

A handsome showroom and a collectors' office have also been opened in the main thoroughfare, Fawcett Street, and schemes for the hire and hire-purchase of equipment have been put into operation, and are bringing new consumers to the undertaking at a greater rate than ever before.

The cost of these developments has been £320,000, and the whole of the work has been carried out on the advice and under the supervision of the general manager and borough electrical engineer, Mr. A. S. Blackman, M.I.Mech.E., M.I.E.E., who has been in charge of the undertaking since Sir John Snell left Sunderland in 1906; he controls a staff which now numbers some 270 persons.

A Country-House Installation.

An account of an automatically operated plant in Scotland, which utilises fuel oil and is designed for the recovery of the waste heat generated by the engine.

TO provide a sufficient supply of cheap electricity for all purposes likely to be wanted on the country estate of Lindertis (see fig. 1), Kirriemuir, Scotland, an interesting installation has recently been designed and carried out by Messrs. John Ogilvy and Co., Ltd., Edinburgh.

The object aimed at was that the plant, fig. 2, should run with the minimum of attention and be very flexible, *i.e.*, be capable of dealing with all loads up to the maximum peak without necessitating adjustment of any sort, or the presence of an attendant. Moreover, it was desired that the above results should be obtained from the smallest possible generating and storage set, in order to keep first cost, depreciation, interest, &c., as low as possible, and to employ usefully as much as possible of the waste heat generated, and thereby still further reduce the cost of power.

The generating set consists of a 30-b.h.p., size 2 VA, Ruston airless-injection, cold-starting, 2-cylinder, vertical heavy-oil engine, directly coupled to a 19-kW, B.T.-H 450-r.p.m. generator provided with three sets of windings—a shunt winding, a reverse series winding, and a second series winding that is only used for developing additional torque when running as a motor

to start the engine. Its output is from 87 amperes, at 220 volts to 57 amperes at 330 volts, the reverse compound winding keeping the wattage approximately constant.

A Tudor high-discharge battery of 120 cells, fig. 3, having a capacity of 32 kWh at the one-hour rate and 45 kWh at the three-hour rate, has been provided and the whole set is automatically controlled throughout by switchgear supplied and designed by the Austin Lighting Co., Ltd., of Banbury.

While energy for all power purposes is supplied at 220 volts, it was decided, in order to take advantage of the better light and lower wattage of low-voltage gasfilled lamps, to provide current for lighting purposes only at 50 volts by means of a high-efficiency motor-

Fig. 1.—Lindertis, South Elevation.

generator of a special design, run off the 220-volt busbars. It is, of course, realised that a considerable loss takes place with this method, especially at light loads; but, taking into account the fact that energy is generated at a small cost and that the amount used for lighting is a comparatively small proportion of the output of the station, this arrangement was considered justifiable. The motor-generator only starts when the lighting load reaches 5 amperes, and shuts down again when it falls to about 3 amperes, starting and stopping being automatically effected. During the non-lighting hours when the machine is not running, the lighting circuit is automatically switched over to a number of the end cells of the battery, so that light can always be obtained if required.

The arrangement of the motor-generator, made by the British Thomson-Houston Co., Ltd., to the Austin Lighting Co.'s specification, is an interesting one. The shunt fields of both machines are separately excited from the 220-volt busbars and the two armatures are connected in series across the 220-volt supply, the motor pressure being about 170 volts. It will thus be realised that when a lighting load is on, the current in the generator armature is the difference between that taken by the motor and that required by the lamps; by this means the efficiency and voltage regulation obtained are both exceptionally good. There is also a series winding on the generator to compensate for the drop of voltage when it is on load.

The main switchboard consists of four panels as described hereunder:—

1.—On the generator panel the principal device is a drum-type controller actuated by a small servo-motor at the back of the board, which is brought into operation when the battery voltage drops to a predetermined level. It switches the battery on to the generator through a resistance, causing the set to motor, cuts out the starting resistance and extra torque windings in steps, and closes the automatic fuel release valve, thereby allowing the engine to fire. On completion of the battery charge, the controller again operates automatically, shuts down the generating plant and opens the fuel release valve. It can also be operated by hand by a press button, and automatically by a maximum-demand relay mounted on the feeder panel, which starts the plant when a certain station output is reached. The generator panel also contains the other usual instruments, shunt regulator, circuit breaker, &c.

2.—The battery panel is practically the standard Austin automatic regulator panel; it carries the usual master relay for voltage regulation, with pilot motors and relays, limit switches, discharge switch for 200 amperes with 18 regulating steps of two cells each, charging switch actuated by the end-cell relays, reverse-current relay to operate the circuit breaker on the generator panel in the event of the failure of fuel supply, &c., and control switches for putting the various automatic features in or out of action. A reversible ampere-hour-meter with a circular dial of the "Sangamo" type has also been included to indicate approximately the state of the battery. It is, of course, compensated to read slightly low on charge, and there is also a thermo-couple device on this instrument to assist starting at very low discharge rates.

With regard to the control switches, in addition to the usual features, there is a 2-way switch which can be set either for starting the plant on low voltage or ringing an alarm bell at times when automatic starting is unnecessary. Another 2-way switch can be set to stop the charge just before gassing of the cells takes place, or to allow full gassing to take place, with an "off" position to enable the plant to continue running for overcharging purposes. The master relay is set to give a maximum busbar voltage of 230 and a minimum of 217.

3.—The 220-volt power feeder panel accommodates the switches and fuses controlling the various power feeders to different parts of the system. They are six in number, three feeding power distribution boards in various parts of the mansion house, one the cookers and laundry, one the farm, and one the immersion heaters, of which more hereafter. It also carries the maximum-demand relay which can be set to start the generating set at any desired load on the station, as mentioned before.

4.—The 50-volt lighting panel mounts the clapper starting switches for the motor-generator, the automatic change-over switch, from motor-generator to battery and *vice versa*, the necessary actuating relays, feeder switches and fuses to various points, ammeter, voltmeter, &c. In addition, three supply meters are mounted below the panels to register the consumption of various circuits.

It will be realised that in order to make practical use of waste heat in a case like this, it must be generated reasonably near the point where it can be used; this was fortunately possible in the present instance. The engine room is situated in the nearest portion of the old stable block, a building only separated from the Mansion House by a narrow courtyard. A horizontal cylindrical tank of about 1,100 gallons capacity is installed in a convenient position just inside the house for the purpose of heat storage, and is carefully lagged. It is kept full of water by an expansion tank immediately above, fed from the ordinary water supply by a ball cock. From the bottom of the heat-storage tank, the cooling water is led to the engine room where it passes through the circulating pump to the engine water jackets, and thence through a Clarkson exhaust heater, from which it is again returned to the heat-storage tank, re-entering near the top. The circulating pipes and exhaust heater have also, of course, been carefully lagged to prevent unnecessary loss of heat.

From the heat-storage tank a 200-gallon domestic storage cylinder is heated by natural circulation on the indirect method, *i.e.*, it is a duplex cylinder and the water circulating from the engine does not come in

contact with the domestic supply. Radiators of the ordinary low-pressure hot-water variety are installed in the large central hall of the house and supplied with heat from the storage tank. As the hall is at a lower level than the tank, the circulation has to be worked on the accelerated system by a small motor-driven pump. The motor, however, only needs about 100 watts to keep the water circulating at the correct speed, so that the consumption of power for this purpose is trifling.

It will be understood that to balance the requirements of heat and electricity in practice is impossible, as the consumption varies from day to day, and, of course, the radiators are not required in the summer. Provision has, therefore, to be made for this variation, and it is effected in the following manner:—

Immersion heaters consuming 18 kW, or practically the full load of the generating set, are fixed in the heat-storage tank, so that if the electrical consumption does not keep the plant running long enough to fully heat the water in the tank, they can be switched on for a time, during which the plant becomes purely a heat generator. On the other hand, when the electrical requirements are in excess of the heat requirements, provision has to be made to prevent the tank overheating and causing damage to the engine; for this purpose a thermostatic relief valve is used, the thermostat being placed in the pipe leading from the tank to the engine. When the water in this pipe rises to a fixed limit of temperature, the relief valve opens and allows hot water from the tank to run to waste. The cold supply is so placed that the cold water which replaces the excess hot water at once enters the pipe leading to the engine, and cools it to the requisite degree.

A point which may be noticed here is that to work hot-water radiators satisfactorily it is essential that the return water temperature should not be too low; in other words, it is not practicable to cool the water down to atmospheric temperature. It was decided to use a return temperature of about 100 deg. F., the flow temperature being about 170 deg. To effect this it is necessary to retain in the heat tank a supply of what may be termed residual heat, and in practice this works very satisfactorily so long as the plant is in fairly regular use, as with efficient lagging the heat loss from the surface of the tank and pipes is comparatively small. The thermostatic relief valve referred to above is accordingly set to prevent the temperature of the water going to the engine exceeding 100 deg. F.

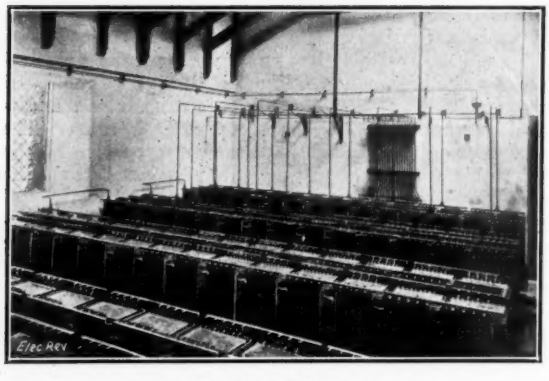


Fig. 3.—The 120-Cell Battery Room.

It will also be observed that as the generating set always runs at full load, and as the wattage is approximately constant, whether charging the battery or running in parallel with it, the heat units given out, and therefore the temperature rise of the water, are also approximately constant. To regulate the temperature rise, it is only necessary to control the amount of water passing through the engine circulation system:

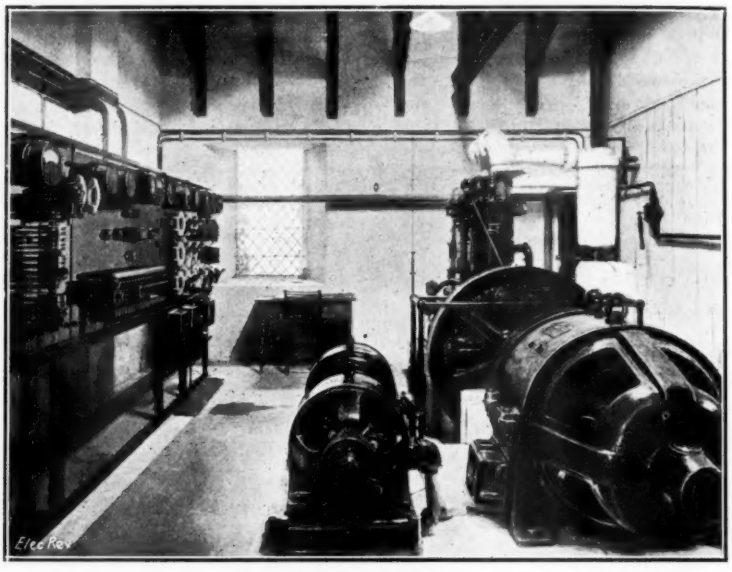


Fig. 2.—The Power House.

in the present case this is effected by throttling the circulation, the pump being of the centrifugal type. It is so adjusted that the rise through the jackets is about 50 deg. F., and this gives a rise of a further 20 deg. F. or so, in the exhaust heater, a total of 70 deg. F.

An estimate of the probable electrical requirements was made, and the size of the generating plant was based on an average daily running time of eight hours under normal conditions. In order to give a constant supply of heat over the 24 hours, it is necessary that the heat storage should be sufficient to absorb the heat generated during the eight hours' run, and that the average rate of heat consumption should not be greater than one-third of the rate of heat generation. It was hoped to obtain about 100,000 B.th.u. per hour from the engine jackets and about 50,000 from the exhaust heater with a temperature rise of approximately 80 deg. F., giving 150,000 B.th.u. per hour in all, and allowing an average consumption of about 50,000 per hour over the 24 hours.

The hot-water radiators installed at present are arranged for a normal output of 22,000 B.th.u. per hour, but this can be adjusted to some extent by altering the speed of the circulating pump, and provision has been made for doing so. Of the balance of heat, some, of course, is dissipated in losses from pipe and tank surfaces, but it is calculated that this loss does not exceed from 4,000 to 5,000 B.th.u. per hour, and the rest is available for heating the domestic water supply.

Tests indicated that the quantity of circulating water needed to give a 50 deg. F. rise in the engine jackets on full load was 170 gallons per hour; therefore, the B.th.u. from—

Engine jackets per hour are $1,700 \times 50 = 85,000$
Exhaust heater, 20 deg. rise, are $1,700 \times 20 = 34,000$

Total = 119,000

This is rather less than the original estimate in both cases, but the data available were not sufficient for exact calculation. A certain amount of heat loss takes place, of course, from the engine surfaces, which cannot well

be lagged. The actual result obtained is, however, sufficiently satisfactory to warrant the installation of the apparatus, and future improvements are no doubt possible.

It is a simple matter from the figures available to work out the overall energy efficiency of the plant, or ratio of heat units in the fuel to energy given for useful employment. The suppliers of the fuel oil in use give its heat value as 19,900 B.th.u. per lb. A careful consumption test under working conditions taken over three hours determined the following figures:—

Oil consumed	43.25 lb.
Average load	19.17 kW.
Oil per hour	14.42 lb.
Oil per b.h.p.-hour	0.476 lb.

(assuming generator efficiency = 85 per cent.)

Thus, 14.42 lb. oil = 287,000 B.th.u.

Converting electricity to heat units—

19.17 kW-hours	= 65,000	B.th.u.
Energy stored as heat	= 119,000	,,
Total	184,000	,,

Energy efficiency = 184,000/287,000 = 0.64 so that 64 per cent. of the total heat in the oil is being usefully employed, assuming the oil supplier's figures to be correct.

The cost of the energy unit works out as follows:—The cost of fuel and lubricating oil per kilowatt-hour generated, at present prices, is about ½d. The electrical equivalent of 119,000 B.th.u. is about 35 kW-hours and 19 kWh is generated electrically, *i.e.*, taking the equivalent of 1,000 watt-hours as the energy unit, the cost is 9.5/(19+35) = 0.175d., which is a satisfactory figure, especially for a private installation in the country, where the cost of oil is, of course, higher; in this case it is over £7 per ton.

The labour cost is very trifling, as beyond ordinary cleaning operations and a few periodical observations of the condition of the battery, meter readings, &c., the only labour necessary is for filling the fuel tank, oiling a few points on the engine, standing by the plant for a few minutes daily to make sure that everything is in order, and finally seeing that a periodical overcharge is given to the battery.

As regards automatic working, it is found best to start the generating set by push button at a fixed hour every morning, stand by for a few minutes, and then leave it to look after itself.

The station is capable of dealing with peak loads up to 44 kW without necessitating operations of any kind on the part of the attendant. As previously mentioned, at times of peak load, as soon as the load rises to a fixed amount (at present about 22 kW) the generating set is started by the maximum-demand relay, and continues to run until the load is reduced and the battery again in the fully-charged condition.

Not much need be said about the arrangements in the house. The whole wiring system is metal-clad, being lead-alloy sheathed with cast-iron boxes at all outlet points, and all the distribution boards are ironclad. The power circuit wiring is, of course, entirely independent. Power sockets of heavy 3-pin type with interlocked d.p. switches of the "MK" make, all in sunk iron boxes with flush plates, are installed in practically every room to permit of the use of radiators and other appliances. There is a separate circuit from the power house to the kitchen and laundry, the former being fully equipped with electric cookers. There are 236 lighting points, 134 2-way and intermediate switches, and 38 power points.

Rural Electric Lines.—IV. (*contd.*)

A Symposium of the opinions of electrical engineers experienced in the construction of overhead lines in rural areas, with examples of methods that have been, or are to be, adopted for the distribution of electricity at low and medium pressures.

Line Construction Regulations.

By W. FENNELL, M.I.E.E.

(*Continued from page* 337.)

Extra-high-pressure regulations are in principle very good indeed, and there is little, or no, hardship when they are applied to main transmission lines. It is quite possible to misread them, but when one has studied and worked to them for a year or two, the real engineering knowledge displayed in their preparation becomes apparent through the entanglement of words. A warning should, however, be given against reliance being placed upon the earthing guards referred to in the regulations as being an acceptable device to earth a falling wire. They have caused one wire on the writer's system to fall, due to large birds causing a permanent arc; in fact, they have been the origin of the only dangerous conditions which have so far existed on his 33,000-volt system. The double-suspension double-wire form of construction for road crossings is quite safe and is little more costly than others.

Having said so much in acceptance of the e.h.p. regulations for trunk lines where cost is not a relatively serious matter (that is, where the high cost can be borne by the profit on the considerable power transmitted), it is necessary to say that for country lines (both e.h.p. and low-pressure, whether country or suburban) the Regulations are hopeless, and are preventing adequate rural developments.

Country Lines, E.H.P. and Medium Pressure.—The important conditions which warrant a reduced standard for country work are the facts that (i) if the liability per mile of a country line to fall and remain alive were even twice that of a line near a town, the risk per individual in the country is, because of the sparse population, only one-tenth of what we may call the suburban risk; and (ii) the country line and its benefits can only be obtained by reducing capital cost to its lowest point. The first reason is really sufficient: any insurance company would accept the country risk on the existing regulations at a much lower rate than the suburban risk, and the Commissioners may reasonably be asked to restrict their aim to a uniform standard of personal safety. They would not claim that the individual countryman must be ten times, or even twice, as safe as the suburban dweller!

Of the making of rules there is no end, and as certain highly placed officials have taunted us with the alleged "fact" that the present rules were made by "our own representatives," one may go so far as to say we have appointed no representatives, and that the time is not yet ripe for the drafting of new rules. Permits should be given to responsible undertakers to try out new methods upon the condition that they may be revoked forthwith if need arises: the results of those trials should be collected and published before rules are formulated. The following notes indicate the writer's views as to changes which would reduce the cost of country work materially, without causing an increased individual risk, or any injury to the Post Office system, and he urges that for rural work permits should be given for:—

1.—The abolition of all guards, such as the split-neutral wire, Trotter guards, &c., in the case of lines not exceeding 250 volts to earth, coupled with the substitution of double suspension, double conductor for road crossings, and double suspension, without double conductor, along roadsides and within 10 feet of the highway in public places. Practically, this is the adoption of e.h.p. methods for l.p. lines.

The abolition of earthing guards for high-pressure lines provided with double suspension, along highways, when at least 10 feet from the causeway, or "made" footpath.

2.—The use on high-pressure secondary lines of earth plates, four to the mile on the earthed-neutral or return circuit. This would ensure a safer line, because a break of the return wire would not leave it alive at the distant broken end as at present, and would reduce the number of wires by one, *viz.*, the earth wire, and therefore the pole size could be reduced. There is no evidence that the Post Office would be affected; in fact, the writer has evidence to the contrary. The return current would be so small that the shunted portion returning by the earth would be negligible.

3.—The reduction of pole heights on high- and low-pressure lines: (*a*) by taking the lowest live wire as the standard for height calculations, instead of the lowest conductor; (*b*) by adopting the temperature of 120 deg. F. as the basis for all height standards, ignoring ice loading conditions for this purpose. One does not cart hay in a blizzard!

4.—The adoption of $\frac{1}{4}$ inch ice loading for strength calculations as the standard for high-pressure lines, as is now the rule for medium-pressure lines.

5.—The fixing of the minimum heights at the following levels: (*a*) for roadway crossings, 20 ft. above the lowest wire (whether earthed or not) as at present, and 18 ft. over a carriage way (not being a highway) or farm road or gateway forming a cart entrance to premises or land; (*b*) for lines across mowing grass or cultivated land, or within 5 ft. of a carriage way, 18 ft. to the lowest wire (whether earthed or not); (*c*) for lines along hedgerows, over moorland, commons, and land where crops are not carried, 18 ft. to the lowest unearthed wire, and 16 ft. 6 in. to the lowest earthed wire.

6.—The drop of pressure limit of 4 per cent. up and down, fixed in the carbon-filament lamp days, can now be increased to 8 per cent. for metal-filament lamps with the same variation in light. An allowance of ± 8 per cent. can be made for country work at any rate. The 4 per cent. limit simply cannot be complied with, and has never been complied with on any extensive system even in cities. The transformer drop, plus the generator variations, exceeds 4 per cent. without allowing for line drop! One does not like to be a law breaker, even when it cannot be helped. The 4 per cent. variation regulation is kept by undertakers just as much, or little, as the 20-mile-an-hour legal speed limit is kept by the Home Secretary's car. He might keep a 40-mile speed limit, just as we might keep an 8 per cent. variation regulation!

Post Office Requirements.

The iniquitous "second-comer" extortion is beyond words, and cannot be discussed. There can never be peace and goodwill between electricity undertakers and the Post Office while that claim is enforced, whether it be legal or not.

P.B.J. Insulation.—Permission to use P.B.J.-insulated a.c. circuits up to 250 volts to earth was secured about 18 months ago by the writer on an appeal to the Commissioners, under Section 14c of the 1899 Act, after two years of hard work in correspondence with the departments. This has swept away all the elaborate and dangerous cradle guards for a.c. work up to 250 volts to earth, and it is well that undertakers should know of it. T.E. 80 has not been withdrawn, and is still sent out without amendment by sectional engineers, who presumably do not know it is out of date.

Heat Coils and Fuses.—The Post Office fixes these as a matter of course in all new telephone exchanges, and has for many years adopted them for all town exchanges. In the country, however, they have been omitted from the older exchanges. The Post Office now demands that we pay for them. The writer is resisting this on the ground that, if P.B.J. is effective, heat coils are not required because of our work. If P.B.J. is not effective and if heat coils are, then it is unfair to put us to the expense of providing useless P.B.J.; in other words, it is unjust to ask us to pay for two forms of protection in series. This claim is akin to the "second comer" claim, in principle, or rather in the lack of it, and it should be resisted wherever it is put forward.

High-Pressure Crossings.

Since cradle guards were "invented," they have become unnecessary by the introduction of double-wire double-suspension, which renders it inconceivable that a wire can fall. The demand that steel towers be used to support the power line at crossings, to prevent overturning, is an unreasonable requirement which should not be insisted upon. A well-stayed wooden pole is quite as safe, indeed, it is safer than an unstayed steel tower, and cannot overturn. The cost of such steel-tower crossings is of the order of £300, and the result is appallingly ugly. The extra cost of double suspension and stays, including the unnecessary cradle guard, would be about £50. It is preferable to ask the Post Office to cable its crossing if its line is not a real trunk, or does not exceed, say, one dozen pairs. Readers of the ELECTRICAL REVIEW will remember correspondence some 18 months ago in which the writer urged this reform, and it is hoped that some reform is on the way. The writer is also endeavouring to persuade the Post Office to use a suspended cable instead of going underground, as that department's underground work is so expensive. The suspended work can be done by a linesman and mate, whereas underground work, as carried out by the Post Office, involves conduit. It does not use local labour, and heavy "walking time" is involved for labour and expensive transport charges for material. As the Post Office uses so much suspended cable for its own work, it is difficult to see how it can refuse its use in our case, especially for country work, and the writer is hopeful.

Alternatively, the writer has obtained consent to suspend an armoured power cable from a steel wire, which would cost much less than going underground, because the use of terminal poles and stays is avoided, as the line stress is carried through by the steel strand. Up to 6,600 volts, wire-armoured ozone-proof cable will be better than lead-covered cable, because it is much lighter and the cost of sealing boxes will be avoided. If the earthed-return system is allowed, a single armoured wire can be used for single-phase work, which would make such a crossing far cheaper than any other method.

Cost of Post Office Work.—The practice of the Post Office of charging 10 per cent. on an already enormous cost of work to cover "establishment charges" is unreasonable, and it is of doubtful legality. It cannot be claimed that casual work, such as ours, involves the Post Office in any extra charges for salaries, rents, rates or taxes. The writer has asked Post Office engineers if they receive extra salary for our extra work, and they cannot trace the receipt of it!

Rural Lines.

There is some misconception as to what is meant by the words "rural work." An extension of a 400-V four-wire underground main for half a mile or so overhead into an outer suburb is not a rural line. Such mains cannot supply power, and even one cooker in the last house will paralyse the scheme. It is necessary for rural work to provide a line at low cost extending far beyond the economic limits for low pressure. Such lines may form a 10-mile loop and will not often produce an immediate income of more than £50 per mile of route.

A Few Hints on Retail Purchasing.

Points to watch when buying stock.

AN important function in the development of a business is the purchase of stock, and too much thought and trouble cannot be exercised in this direction. A judiciously selected stock is the one that sells best, naturally, and the following hints will possibly be of use to those engaged in electrical retailing.

The retailer who wishes to be up-to-date should study every catalogue and price list sent to him, so that he may have a good knowledge of all new lines and price reductions. He should also place all catalogues in some safe place, so that he can put his hands on any particular one with the minimum of delay.

Samples, which are more often than not thrown into some odd corner and very soon lost, should be dealt with in a similar manner. To each sample should be attached a label indicating the origin, proper name, price and list number of the sample, and any further information that may seem necessary. Samples are regarded by many retailers as more of a nuisance than a help, but this view is quite wrong, and all retailers should study and preserve any samples that they may receive.

Co-operating with the Traveller.

A problem with which the retailer is confronted at one time or another, is the traveller who calls at a busy hour and stands about the shop when it is full of customers, or who, when business is slack, will indulge in idle chatter over a period which the retailer had reserved for his clerical work. It is easy enough to be rude or abrupt under these circumstances, but it is not wise.

Travellers should not be discouraged; they have their work to do and, since they are the connecting link between the manufacturer and the retailer, that work is of some importance. Always be courteous and tactful with the traveller; give him a good impression, and he may be able to put in a useful word in the right quarter.

A good method of avoiding this difficulty is to display at the entrance to the shop a politely-worded notice requesting travellers, in the interests of customers—who must have prior claim to the services of the retailer—to call only between certain specified times. In passing, a prospective customer, reading this notice, cannot fail to be impressed by the suggestion that every effort is being made to study his convenience.

Samples and Goods May Vary in Quality.

There are two important points to bear in mind when placing an order through a traveller, or as a result of his call—quality and delivery. Although the statement is open to reservation, travellers' samples and actual deliveries are liable to vary in quality, the sample often being the better article. If an order is made on the strength of a sample, it should be stated on the order that the acceptance of the goods is conditional upon their being equal in quality and performance to the sample, which should be retained by the retailer for purposes of comparison. This is a simple precaution, yet it may mean much.

On the subject of delivery, a traveller will sometimes attempt to book an order on the advantage to the retailer of immediate delivery, yet after waiting for a few days the trader is informed that delivery cannot be effected for a week or more. Usually this is a pure accident, but in many cases it is quite unforgivable.

The retailer should stipulate quite clearly on the order that delivery must be completed by a certain date. He is then at liberty to cancel the order if the supplier fails to comply with this condition, and he is not liable to any claim for breach of contract. Failure to adopt these measures has often resulted in retailers being left with stocks of unsaleable goods.

Local Agencies.

It is no rare occurrence for a traveller to make the tempting offer of a sole district agency if the retailer places a fairly large order for the specific goods, the traveller promising not to call upon competitive firms in the district. The retailer goes out a few days later and sees the same goods displayed in the window of his competitor. Such a happening, however, is not so common nowadays as it was a few years ago, and it is easily guarded against.

As a rule travellers are not authorised to appoint district agencies on their own initiative, and if any retailer is inclined to agree to such a suggestion he should at once obtain confirmation in writing from the supplying firm, making his order conditional upon this confirmation being received.

Sale or Return.

From time to time the retailer will, no doubt, be offered goods on the basis of sale or return, and it will generally be a condition that such goods, if unsold, should be returned within a stated period. This sometimes gets overlooked in the rush of business, the result being that a demand for payment will be received.

Most of the more reputable firms will not be inconsiderate in such cases, but many retailers have been badly bitten by some small firms anxious to unload their goods just anyhow, and retailers should be wary of accepting goods under these conditions except from firms well known to them.

How Orders Should be Given.

Always make sure of any special conditions which may accompany an offer of sale, and if verbal orders are given a written confirmation should be forwarded without delay. These should be written on a proper order form and should be very clearly given. Order forms should be bound as a loose-leaf book, numbered consecutively, and each form should have a duplicate sheet.

When goods on order are delivered, they should be checked against the order without delay, any fault or deficiencies being reported immediately to the supplier, and defective goods being returned at the same time. If this is not done for more than a couple of days the supplier may refuse to consider the complaint. The carriers' notes should be signed "unexamined" in cases where it is not possible to check goods on delivery.

An advice or contents note usually accompanies the goods, or is forwarded through the post, and the goods must be checked against this. It should then be filed, so that when the invoice arrives it can be checked against the advice note.

Buying is only too frequently treated carelessly, with disastrous results. It is on the basis of buying the right goods in the right quantity at the right time and in the right place, that the development of a business depends. Bad buying negatives good selling—and spells loss.

Domestic Electricity.

A Woman's Point of View.

By I. M. OLDING.

WOMAN, the pioneer of sex equality, is the most advanced creature in the world: Woman, the housewife, is the most conservative being living. To gain her right to be considered equal to man she acts in the most modern possible manner, yet modernity in the home, representing for her considerable saving of labour and time, is too rarely given adequate consideration. Labour-saving is a problem with which a few pioneers have long been battling, but so far the average woman has taken but little interest in their work.

The "advanced" woman dislikes being reminded of the fact that "woman's place is in the home," but when compelled by circumstances to manage the affairs of a household, she appears to delight in unnecessary and over-fatiguing labour, and plods on, apparently not questioning the cause of her seemingly endless duties, or else declining without investigation to avail herself of the opportunities which science has put before her, by placing electricity at her disposal for all purposes.

Science has done much to bring woman to the advanced stages, and it is remarkable that she does not welcome more gladly its help in the home.

Electricity, in particular, is largely responsible for aiding woman to reach her present situation, yet she shrinks from applying it wherever possible to domesticity, believing, perhaps, that it is difficult to manage, or not within the scope of her income.

With regard to the question of difficulty of handling of electrical apparatus, it is sometimes contended that a deeper knowledge of the fundamentals of electricity would hasten progress. It is, however, clear that this knowledge is not necessary, because such articles as electric fires, vacuum cleaners, refrigerators, &c., which involve practically all the basic forms of energy transformation, can be used by even the most grossly ignorant. Knowledge of the construction of electrical apparatus is far less necessary to the user of electricity than a knowledge of auto mechanism to a motor-car driver, and the ignorance of the average owner-driver, at least, is proverbial.

Lack of familiarity with the elementary applications of electricity has bred a great deal of suspicion in the minds of housewives. This mistrust is fostered by occasional failures or accidents which ofttimes are enlarged on by rival interests.

Then, again, the prevailing idea that the cost of electricity is always prohibitive does much to retard development. It is distinctly unfortunate that more is not done to dispel this fallacy.

Quite apart from the advantage of convenience, electric light is really cheap, even though the energy cost reaches 8d. or more per kilowatt-hour. The essential cheapness of electric light is conclusively proved by the extent to which it is used.

From the figures presented by interests inimical to the electrical industry superficial consideration might lead one to conclude that the case for electricity was hopeless, except for the very rich. But when comparing the price of coal, gas, &c., with that of electricity it must be taken into account that the cost of the first two does not end at the purchase figure. To that amount percentages for inefficiency, the removal of dirt, time spent, the cleaning of furnishings, deterioration in value occasioned by frequent cleaning, and redecoration expenses *must* be added. It will then be seen that electricity is not the luxury it is thought to be, but is economical and a *money saver*.

Many users of electricity, especially in the provinces, have shown that where reasonable tariffs are in force, the daily cost of energy is not much more than the average man's cigarette bill.

The progress made in the use of electricity, even without any proper general organisation, is the best evidence of its value, and its popularity to-day not only emphasises its unquestionable superiority, but proves that, instead of being the most expensive illuminant, as has been the idea of the general public, it is the cheapest.

Simplicity and cleanliness are not its only advantages. To the artistic mind there is no limit to its applicability, and if the amount of light which can be obtained for the price of a single cigarette were thoroughly realised, larger lamp units could be used and striking decorative effects could be obtained.

Now that woman has shed most of her traditional ideas, it cannot be suggested that she would prefer to see a glowing coal fire in her hearth at the expense of many hours' labour, rather than a substitute giving more warmth and less trouble, and saving her time and money (both of which to "moderns" are precious). To some extent the reason is that the man-produced designs of fires are, or were, most inartistic, and cookers in many instances are mere iron boxes filled with tangles of wire.

It is of interest to note that even from the standpoint of minimum fuel cost the electric fire is cheaper than the coal fire if the period of use does not exceed three or four hours, so that, in addition to the advantages of cleanliness and convenience already mentioned, it has the benefit of economy. For bedroom heating and occasional use, no other type of fire is worthy of consideration.

Most of the work in the home is the outcome of the use of open fires, or similar means of heating—they are the source of domestic troubles and robbers of woman's leisure. And if woman is to be as care-free in the home as it is possible for her to be outside of it, drudgery must be a thing forgotten. How many would enjoy the pleasures of life if not tied by the superintendence of their homes!

Then why has woman not realised that by scrapping her old methods of housekeeping she will unlock the gate to freedom and thus attain the high standard of equality for which she is, and has been, striving?

The electric fire offers her a useful stepping-stone. Its portability has also proved to be of great value to those whose financial means are limited. A 1-kW radiator is amply sufficient for heating the bedroom or sitting-room, so that a penny per hour keeps the occupant comfortable, and this again should be compared with the cigarette bill, which is about a penny per ten minutes.

Cooking, which, with the conventional methods, coal and gas, is merely a nuisance, becomes entirely transformed when good electrical apparatus is available. When it becomes more fully realised how exactly the operations involved in electrically heating the prepared materials to bring them to a proper state can be controlled, the cost of electricity is seen to be of minor importance. With a little care in initial tests a competent cook can reduce her work of supervision to a minimum without having the slightest anxiety as to the quality of the final products.

This feature has been realised to such an extent in

America and on the Continent that quite a number of successful automatic cooking utensils are available in which the operations of switching can be done by a time switch. The good heat-retaining properties of the oven are also invaluable, in that food can be kept at the proper temperature, without becoming dry or unpalatable, for very considerable periods. The effect of this is that the relationship between the time of meals and the time of cooking is more flexible, thus giving further freedom to the housewife in arranging her daily programme.

The very good construction and performance of gas cookers make them the strongest rival of electricity in this field, but although for the moment they have the advantage, they are not likely to retain pride of place very long. The speed of operation due to the high power of the gas ring is an advantage which holds only so long as unscientific general cooking methods are employed.

The writer looks on the present position of the electric cooker as being analogous to that of early motor cars, which were merely ordinary carriages provided with engines, while the present-day electric cooker is merely the gas cooker filled with resistance elements. The difference between the present-day automobile and that of the pre-war period shows how design can alter the whole aspect, and new types of electric cookers are already appearing which show that designers are not entirely following conventional lines of construction.

Although the present cost of electric cookers prevents many women from giving them a trial, in special applications such as toasting, boiling small quantities of water, coffee making, and so forth, the economy and convenience of electricity are unquestionable, and a start should be made with these. The advantages of electricity for small power work are so obvious that they need not be discussed.

An advantage which is not recognised to the extent it should be, is that of getting heat energy in its most valuable and convenient form, namely, radiant heat.

Electricity can assist woman in almost every task set her in the house. For laundry work an electrical washing machine will wash, wring, and mangle. Then there is the electric iron, which is a joy to use, its running cost being almost negligible, like that of the vacuum cleaner, another delightful and valuable labour-saver. With quite a cheap arrangement, drying can be done under the worst weather conditions in a most economical manner by the use of an electric fan, even without supplementary heat. The value of this scheme, which is due to Professor S. Parker Smith, is very great, and it will inevitably become widely appreciated.

Modern apparatus is for the most part very satisfactory, and it is pretty obvious, even to a non-technical observer, that the business expansion of the various manufacturers of electrical apparatus has been almost directly proportioned to the reliability of their products.

In conclusion, the writer wishes to convey in a convenient manner what she feels sure to be the requirements of woman from the electrical engineers of the country. In the first place, electrical tariffs must be made simpler, so that the annual cost of giving electrical service may be readily estimated. In this connection, the proposals for a uniform running charge per unit throughout the country seem to be very sound. The restrictions on the use of apparatus, which in some undertakings are most irritating, should be made more reasonable, as it has now been conclusively proved that the diversity factor between houses is sufficiently large to allow electricity undertakings to give adequate supplies to each house without any danger to their systems.

In power applications, more household aids are required, for instance, in the direction of boot-cleaning machines, and these would surely not disturb the least progressive of electricity department managers.

Electric heating devices are making good progress, but there is still scope for artistic design, particularly in conjunction with cleaning. Cookers, too, have rapidly improved, and those manufacturers who produce iron boxes with sharp shelves and supports which are difficult and even dangerous to clean, should follow the example of good manufacturers who give smooth oven interiors and rustless material.

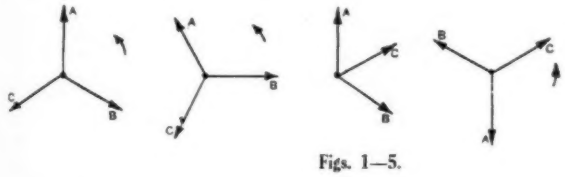
The refrigerators which are on the market leave little to be desired in the way of finish or performance, but we should like to see the price within the reach of a greater number of people.

Phasing-in on Three-phase Systems.

The determination of the correct polarity for the leads of transformers when paralleling or checking the coil couplings and also the cable connections of rotating machinery.

By G. H. BOWDEN.

THE operation of "phasing-in" a generator or transformer is looked upon as requiring great skill, or technical ability, by many who have the duty forced upon them. The possibility of making wrong connections is great, but care for three simple requirements can do much to avoid any error.



Figs. 1—5.

These requirements are: (1) The more obvious, equal voltage and frequency. (2) Corresponding relation between line voltage phase positions; this may or may not call for corresponding relations between the phase voltages of the two machines (it is affected by the mode of connections). (3) Correct phase rotation, fig. 1 correct and fig. 5 reversed; this is covered by (2). If the relationship between the phases corresponds at every instant, correct phase rotation is assured; this shows that it is necessary to phase-in all terminals together. This is to detect errors such as are shown in figs. 2, 3, 4 and 5, which may in certain of these cases not be revealed by taking only two terminals of each for comparison in each circuit to be paralleled.

Phasing-in is necessary when connecting the windings of a delta transformer and a convertor, when connecting the windings of a synchronous motor or generator, and when paralleling generators, transformers, or convertors with the bus-bars of a three-phase system. When phasing-in transformers, which have their primaries already in parallel, the connections are best determined by the use of a voltmeter. Much more information is then obtained than by the use of lamps.

The readings must have definite relations to one an-

other; they cannot otherwise be measured accurately. If the connections are made as in fig. 7, particular attention must be paid to determine that, at synchronism or when phasing-out is correct, the voltage across

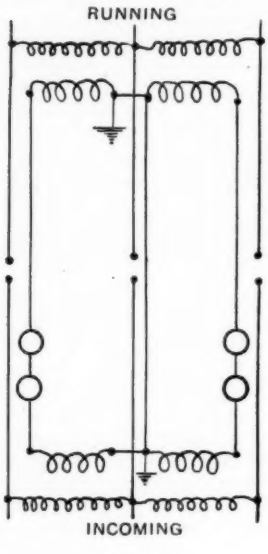


Fig. 6.

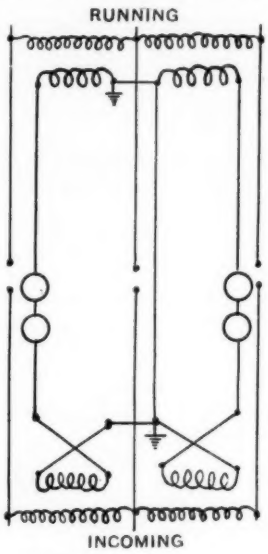


Fig. 7.

the lamps is exactly double that of one of the transformers, assuming all the transformers to be of equal ratio.

Fig. 6 shows a method adopted for phasing-in l.p. machines or transformers. The lamps will be dark at synchronism or when the phases correspond. Lamp circuits should be tested in the case of a transformer, as broken lamp circuits may give false indications. All the lamps will glow and grow dark in unison when the main connections are correct, or in succession should the phase rotation be incorrect.

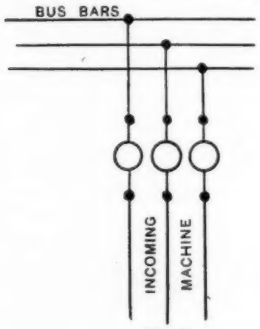


Fig. 8.

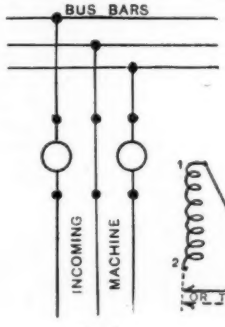


Fig. 9.

When one phase is connected solid as in fig. 9, the maximum voltage across the lamps is twice the line voltage. When three groups of lamps are used, as in fig. 8, each bank will have to withstand double phase pressure or $2/\sqrt{3}$ line pressure. For high-pressure work, the manipulation of high-pressure connections and the use of potential transformers make other methods preferable to those shown in figs. 8 and 9.

When connecting the three coils of a delta transformer, if the polarities are unknown on one side only, the other side should be connected to the normal 3-phase supply, and the coils should be connected as in fig. 10. Lamps, voltmeter, or potential transformer and lamps should be connected across the free ends. The maximum pressure that may be measured will be twice line pressure. Should double line pressure be measured across terminals 2 and 5, fig. 10, connect two of the windings so that the normal line pressure is obtained across their free ends. The third will have to be connected to give zero pressure across the open connections at one corner of the delta, *i.e.*, connected up as in fig. 10. The delta may then be completed by joining terminals 2 and 5 (see fig. 10*a*). Figs. 10*b* and 10*c* show the possible connections due to reversed polarities.

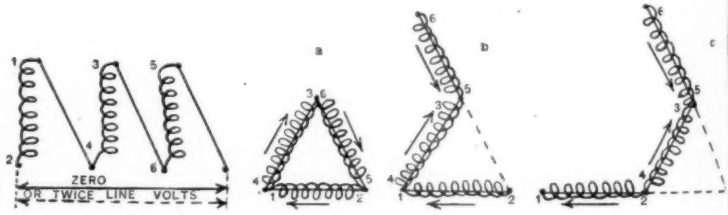


Fig. 10.

To reverse the polarity of this 3-phase winding, each coil will have to be reversed and connected as in figs. 11 and 11*a*. In fig. 11, if 1, 3, and 5 are line terminals for respective phases A, B, and C, this shows standard polarity. (N.B.—Figs. 10*a*, 10*b*, 10*c*, and 11*a* are purely connection diagrams.)

When connecting the three coils of a star-wound transformer or generator, they should be first connected as in fig. 12, if the polarities are unknown. Then they should be excited, by connecting the other winding to the normal 3-phase supply, or by exciting the running generator, as the case may be. The voltage measured across any two of the free line terminals should then be equal, and also $\sqrt{3}$ times the pressure across the terminals of any one phase.

If one or two phases have reversed polarity, there will be one terminal of which the pressure differences between this and either of the adjoining free line terminals are the same, but abnormal; reversing the connections on the phase to which this terminal is connected will give normal 3-phase and equal pressures between the line terminals. If in the case of a transformer the polarity of each is incorrect, this is remedied by reversing the connections of each phase (fig. 13).

Fig. 13*a* shows vector diagrams for the normal and for the incorrect phase connections.

The necessary measurements in the case of low-pressure work can be made with carbon lamps arranged in series, but accurate and more straightforward working is secured by the use of a suitable multi-scale voltmeter. Where lamps are used, they are best mounted in batten holders fixed upon a board, say, 20 in. by 8 in.

Where the apparatus concerned works at high pressures, the use of potential transformers becomes necessary. The high-pressure operation is confused by the questions of secondary earthing and of relative polarities of such potential transformers. The former is necessary by reason of possible leakage between the high- and low-pressure sides of the potential transformer, also because of the danger resulting from static charges. Sometimes the polarities can be determined by inspection of the potential transformer windings. Assuming the direction of winding to be the same as shown, figs. 14*a*, 14*b* and 14*c* show the relative polarities of the two windings.

A safe way to reason out the polarities of the windings is as follows:—The load current in the primary or

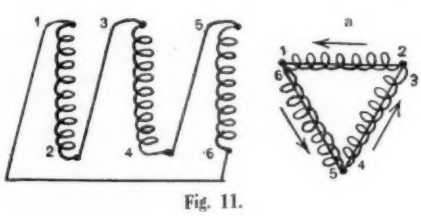


Fig. 11.

h.p. side at a given instant tends to produce a flux in a certain direction in the core; at the same instant the load current in the secondary or low-pressure side tends to oppose the production of the flux by the primary. When at a given instant the polarity of one terminal of the primary is positive to that of the other primary

terminal, the flow of load current will be from positive to negative through the winding. At the same instant the flow of load current in the secondary circuit will be from the positive to the negative terminal through the secondary load. This shows that when considering the polarities of potential transformers, the best and most straightforward mental operation is to consider relative potentials and not relative directions of current flow.

There is a practical method of determining transformer polarities (see figs. 15 and 16).

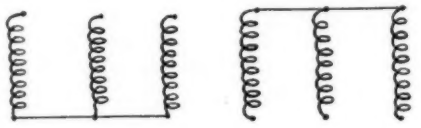


Fig. 12.

Fig. 13.

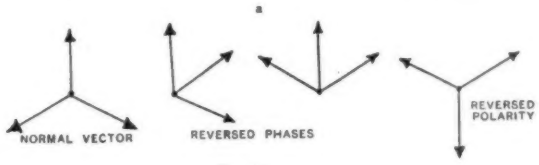


Fig. 13a.

For a single-phase transformer, join one h.p. and one l.p. terminal together, *i.e.*, 3 and 2, and connect the h.p. terminals to an a.c. supply, *i.e.*, 3 and 4. Measure with a voltmeter the pressures between 1 and 4 and between 3 and 4. If the polarities are as shown in the diagram, the pressure across 1 and 4 will be less than across 3 and 4. If the polarities are reversed on the l.p. side or h.p. side only, the pressure across 1 and 4 will be more.

This may be checked with advantage where the transformers are of large ratio by connecting 1 to 3 and taking pressures across 2 and 4 and 3 and 4. Then when the polarities are as shown, the pressure across 1 and 4 in fig. 15 will be less than the pressure across 2 and 4 in fig. 16. If the polarities are reversed on one side, the contrary will obtain.

Care must be taken to avoid placing the l.p. supply across the secondary. The determination of actual polarities is not always necessary, and when phasing-in, the relative polarities often afford sufficient guidance. This is so where one panel of a switchboard is being phased-in with the p.t.'s of an adjoining one. Here the advantage of colouring or otherwise suitably distinguishing the phases of the main high-pressure conductors is clearly demonstrated.

The high-pressure sides of the transformers in the two cubicles can be connected together and the corresponding l.p. terminals suitably marked on each, *e.g.*, fig. 6. The safest way, perhaps, which admits of no error is to make both panels or cubicles alive from the bus-bars, and by suitable tests determine the corresponding terminals of each group of p.t.'s, assuming that two single transformers or one 3-phase transformer are used in each.

Then if the potential transformer connections are made so that polarities and phases correspond when both panels are connected to the bus-bars, it follows that when the incoming machine or transformer panel p.t.'s, excited from the connected machine or transformer, correspond in all ways with a machine connected with the bus-bars, it is safe to connect the incoming panel to the bus-bars.

When rotating machines, such as generators or convertors, are being phased-in, the connections of the p.t.'s may be as is usual in normal service. When the connections of p.t.'s and main conductors are correct, all the lamps if connected as in fig. 6 will shortly pulsate from complete darkness to full brightness; the max. voltage they will be subjected to is double that of the p.t. secondary, *i.e.*, usually 220 V (assuming that the running and incoming machines are excited to normal running pressure). In this case the lamps will be dark at the instant of synchronism.

Fig. 7 shows the same method, with the difference that the lamps are full bright at the instant of synchronism.

Supposing that the synchroniser connections on the panel of the incoming machine are known to be correct, and the internal phase windings are correctly connected, the only test to be made is that for phase rotation. This is best done by a small 3-phase motor connected as in fig. 17.

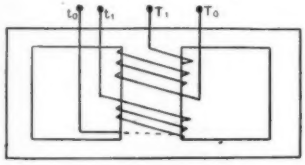


Fig. 14a.

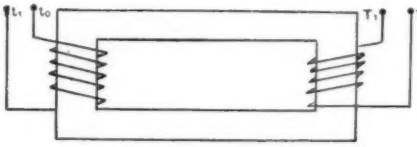


Fig. 14b.

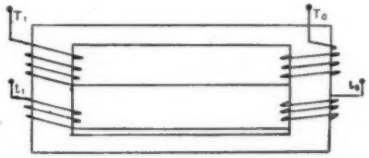


Fig. 14c.

The connections shown in fig. 18 serve the same purpose, but greater care is needed, and the risk of mistake is greater than in fig. 17. Due to a cross in the leads at point x, a 6,000-kW generator was switched on to a 60,000-kW system with wrong phase rotation due to this method.

When carrying out phasing operations, it is especially important that the l.p. leads to the p.t.'s be readily traced out and the leads or terminals clearly marked.

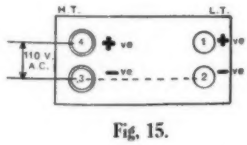


Fig. 15.

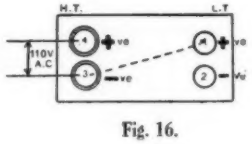


Fig. 16.

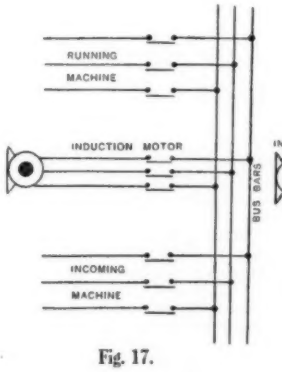


Fig. 17.

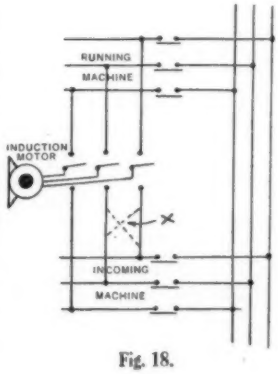


Fig. 18.

Operations involving contact with h.p. conductors are best kept to a minimum, and the continuity and insulation of leads or lamps should be above suspicion, else false results may be obtained.

Assuming that normal potential transformers are used, the question of primary and secondary phase-angle errors will make no material difference.

D

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Empire Production and Trade.

In his speech at the annual meeting of the British Empire Producers' Association, on August 23rd, the chairman (Mr. Ben H. Morgan) said that export was a vital necessity to all parts of the Empire. By breaking down the barriers to inter-Empire trade and encouraging production and commerce by preferential arrangements of all kinds, Great Britain, as well as the outlying portions of the Empire, could become extremely prosperous. Mr. Morgan pointed out the loss which the Empire incurred by reason of adverse balances on trade with foreign countries. He instanced the United States, which in 1926 sold to us £229,000,000 worth of goods and bought less than £48,000,000 worth from us; and Germany, whose imports from Britain were valued at £26,300,000, while her exports to Britain had a value of £72,700,000.

A "Kelvinator" Display.

We have on previous occasions illustrated the show windows of Messrs. Walker Bros., Birmingham, for their displays are characterised by originality and effectiveness; moreover, no arrangement is ever allowed to stand long enough to become stale. The latest display "staged" in the premises relates to

A Kelvinator Display at Birmingham.

"Kelvinator" refrigerators, and is shown in the accompanying illustration. It was arranged with the co-operation of Mr. S. Hodgson, the Birmingham agent of Kelvinator, Ltd., and its simplicity adds to its attractiveness.

Armstrong-Whitworth's Difficulties in New Zealand.

The Auckland correspondent of the *Financial News* says that a serious deadlock has arisen between Messrs. Armstrong, Whitworth & Co., Ltd., and the New Zealand Public Works Department over the Arapuni hydro-electric contract, owing to the former's inability to obtain secure foundations for the power house, the site of which on the river bank is constantly flooded, despite all efforts to exclude water. Although construction on the main dam and other headworks is proceeding rapidly, work on the power-house site is suspended. It is understood that the deadlock involves the interpretation of the contract, the chief issue being whether the contractors are entitled to rely on the department's description of the natural conditions or whether they are required to make their own investigations, accepting responsibility for unforeseen developments. The Public Works Department's chief electrical engineer has declined to comment on the situation, as the matter will probably be the subject of litigation. Whatever solution is reached, the completion of the scheme must inevitably be greatly delayed. The dam across Waikato Gorge will be completed this year, but it is unlikely that the power-house will be ready before the end of 1928. At present the loss is estimated at between £140,000 and £160,000. *Reuter* reports that there is a prospect of an amicable settlement of the dispute.

E.D.A. Activities.

The British Electrical Development Association has issued a reprint of an article on "How Electricity is Made," which was recently contributed to "The Electrical Age for Women" by Mr. J. W. Beauchamp. This goes further than its title suggests, as it deals not only with generation, but also with distribution, metering, and application. The booklet should prove a useful weapon in the electrical armoury.

A statement regarding the cost of operating appliances appears, and we think that, in his anxiety to be scrupulously fair, the author has in two or three cases placed the consumption at too high a figure. We refer particularly to the iron (150 kWh per year), the suction cleaner (150 kWh), partial water heating (2,500 kWh), and the washing machine (50 kWh). On the other hand, the given consumption of the wash copper is perhaps too low. Comparable American figures based on the returns of electricity supply companies show much lower figures for everything except refrigerators.

Another recent publication of the Association is "E.D.A. No. 112," which contains reproductions of the newspaper advertisements which are to appear during the forthcoming "Circle" Campaign. These are of varying sizes, and fall into seven sections, dealing, respectively, with wiring and installations; lighting; domestic appliances; small heaters and cookers; large cookers; heaters and water heaters; and Christmas presents. The last class is designed especially for the National Electric Week (ending December 3rd). A special registration form for the use of circles, undertakings or firms is included, upon which can be stated the names of the selected newspapers, the best advertisements for use in them, and the best days for the appearance of the advertisements. The advertisements themselves are of a high standard, telling the electrical story forcibly and without undue embellishment. Each includes the "slogan" "For Health's Sake Use Electricity."

In connection with the National Electric Week, the Association has produced a striking window display for the use of electrical dealers. This is depicted in a folder which has been sent to all undertakings and firms on the E.D.A. mailing list. The display consists of a large six-colour screen (72 in. by 48 in.) with a four-colour base; a cut-out female figure with a giant switch (39 in. high overall); a pictorial electric fire with a transparent front for illumination; eight pictorial cut-outs of electrical appliances; and twelve yards of two-coloured cord linking the "appliances" to the "switch." It is requested that applications for the display be sent in immediately.

Rumoured Canadian Marconi Deal.

The Toronto correspondent of the *Financial Times* states that it is rumoured that the Canadian Pacific Railway Company is likely to purchase a substantial interest in the Canadian Marconi Co. from Messrs. Lazard & Co. The Canadian Pacific Railway already has a connection with the Marconi Co., and credence is given the report by the fact that the Mackay Companies, the Canadian Pacific Railway Co.'s United States connection, recently secured radio rights through the purchase of the Federal Telegraph Co.'s system. It is suggested that the Mackay Companies will handle the Trans-Pacific radio business and the Canadian Pacific Railway the Trans-Atlantic business.

Australian Accumulator Manufacture.

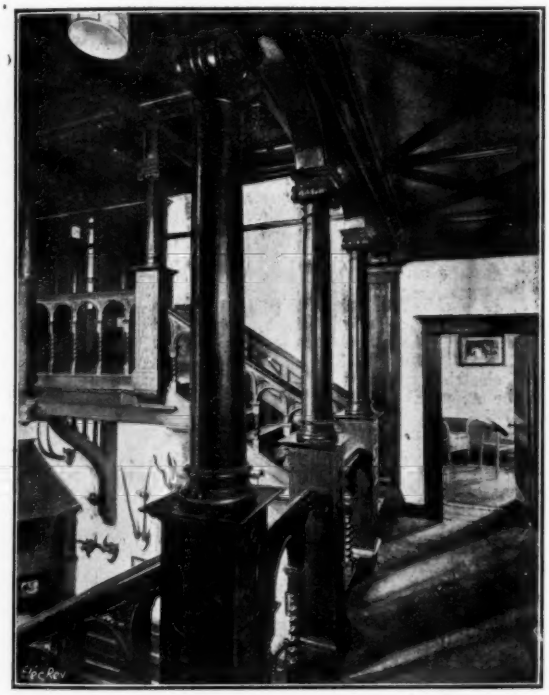
The Sydney *Daily Guardian* reports that Mr. Forbes Mackay, the manager of the City Electricity Department, recently declined to accept a tender for accumulators of Australian manufacture. He considered that the company making the offer had had insufficient experience in the production of large batteries, being mainly concerned with automobile types. He therefore recommended the acceptance of the tender of the Tudor Accumulator Co., Ltd., at £4,691, comparing with the Australian firm's price of £5,915.

German Wage Award.

The arbitrator's award in the dispute over the question of hours which has been raging in the electrical manufacturing and fitting industry has just been issued. It applies throughout Rhineland and Westphalia. The week shall be considered as 48 hours working time, but workers may be called upon to work, if required, up to but not exceeding 56 hours. The new rates for overtime are as follows: For the first three hours, 50 per cent. extra; the next two hours, 30 per cent.; and 25 per cent. for the following three hours. The parties had until August 29th to accept or reject the award, which, if accepted, remains in force until September 1st, 1929.—*Reuter* (Dortmund).

An Excellent Social Club.

Broad Green Hall, a fine old Elizabethan mansion, has recently been opened as a club house and social centre by the A.T.M. Sports and Social Organisation; all employés of Automatic Telephone Manufacturing Company, Ltd., are eligible for membership at the nominal subscription of 1d. per week. The clubhouse and grounds adjoin the company's Victor Works and are well adapted and conveniently situated within picturesque surroundings for the purpose. Accommodation has been found for a large bowling green and tennis court, together with a golf-putting green. A fine range of glass-



A View of the New A.T.M. Club.

houses is fully equipped for tomato growing, grapes, peaches, &c., the produce of which is available to members. The substantially built club house has been furnished and decorated in keeping with its period. There is an exceptionally fine hall with carved oak balustraded staircase and balcony, surmounted by a carved and panelled ceiling. (See the accompanying illustration.) A fine collection of African antelope horns has been presented to the club by Mr. G. W. Moore, director and manager of the company. Opening off the hall is a music room, equipped with a grand piano, and available for concerts and dances. There are also a billiard room, a library-lounge, a bar, a card room, committee room, ladies' lounge, dressing room and workroom, a cloakroom, and a games room.

Improved Plywood Cable Drums.

Since more effective methods of packing the smaller wires and cables for general installation work were adopted by British cable makers, it has become common practice to wind most of the lead-covered v.i.r. wire and cables and heavier rubber cables on plywood drums. These drums are usually provided with a sheet metal hub giving strength to the central portion of the drum, but owing to the heavy weight carried, stresses are set up whilst the drums are in transit which sometimes cause the flanges either to collapse altogether or the plywood to fray and splinter at the edges of the flanges. With the object of minimising this damage, the Enfield Cable Works, Ltd., is now delivering the cables mentioned on plywood drums having distance pieces placed between the edges of the flanges after the cable is wound on the drum. These distance pieces are kept in position by steel binders threaded through slots in the flanges, so strengthening what has been in the past the weakest part of the drum. A patent has been applied for by the company.

The German Wire Syndicate.

As a result of the conflict of interests and the increased competition of outside firms, it is stated that a complete reorganisation of the Conducting Wire Syndicate is to take place. The sales syndicate has abandoned the price convention, and after the clearance of the existing stocks it will suspend its sales activity. It is, however, proposed later on to enter into negotiations with a view to the re-constitution of the syndicate, to include merchants in a larger measure.

United States Foreign Electrical Trade.

The value of electrical exports from the United States during June last declined in comparison with May and with June, 1926. The total was $7,612,670, as against $8,591,721 in the corresponding period of last year. The figures for the first six months of 1927 give a total of $48,470,084, showing an increase of $210,000 over the first half of last year. The decline in the June total is attributed to the falling off in shipments of telephone switchboards from $1,507,038 to $11,561. Other large decreases occurred in the cases of a.c. generating sets ($157,110), unspecified apparatus ($112,262), and bare copper wire ($156,486). The most important increase was in motor-driven household devices—from $101,001 to $257,158; electric lamps increased by $76,647, and there were substantial rises in electric fans, tools and accessories, parts for motors, and refrigerators.

The import total decreased from $315,990 in May to $299,027 in June. The principal class was carbon filament lamps, which were valued at $120,548, and radio apparatus to the value of $31,620 was imported. The principal supplier was Germany ($100,522); Japan was credited with $99,713, Switzerland with $43,377, and the United Kingdom with $25,926. The British share was $66,929 lower than in May.

Liverpool Civic Week Exhibition.

The following electrical companies intend to exhibit at the Liverpool Civic Week Exhibition of Commerce and Industry from September 23rd to October 1st:—The Liverpool Electric Cable Co., Ltd., the Castle Fuse and Engineering Co., Ltd., and Messrs. H. T. Boothroyd, Ltd.

Unbalanced Production in Russia.

A representative of the State Electrical (High-Pressure) Trust is reported to have said that a condition of over-production is threatened in lamps, while the output of machines and apparatus is insufficient to satisfy the demand. Nevertheless, some achievements have been accomplished in the current year. For instance, 20 generators of from 4,000 to 8,000 kW capacity have been constructed and are working successfully at the Volkhoff, Zemo-Avchalsky, and other stations, machines of such a size not having been made in Russia before the war. A representative of the General Electrical Commission says that, as compared with average world prices the Russian products are 2.6 times dearer, due to the costliness of materials, the slow turnover of capital, &c.

Social Event.

On August 20th, Messrs. A. Reyrolle & Co., Ltd., gave a garden party to their employés and friends at the company's sports ground. Arrangements had been made for tennis, bowls, quoits and cricket matches, as well as for dancing on the green in the evening; and for entertainment by the "Domino Set" Concert Party, and by a Punch and Judy show, but rain fell almost continuously during the afternoon and evening, and although some of the games were started, they, and the evening dancing, had to be abandoned. Shelter for the concert party and for the Punch and Judy show with its old-world puppet play, was provided in partially-built shops now being erected as an extension to the New Town Works. Tea was served in two roomy marquees. The number present was about 1,500, from all sections of the works and offices, and included three of the directors of the company—Messrs. N. Merz, H. W. Clothier, and H. W. Miller.

Can We Teach America?

Miss C. Grunsky recently contributed to *Electrical Merchandising* her impressions of electrical merchandising in England gathered during a visit to this country. After commenting upon the lack of standardisation, both in current and appliances (incidentally making one or two mis-statements), she deals at some length with the E.D.A.-E.L.M.A. Campaign, which appears to have impressed her favourably. She concludes her survey thus: "Though actual merchandising conditions in England at the present time are not such as to excite the envy of American merchants, the excellent methods employed in promotional campaigns now under way are worthy of consideration."

Southend and Foreign Cables.

The Southend Town Council has decided that the electrical engineer shall obtain information respecting Continental firms who have tendered for the supply of cables, owing to the disparity in price between the English and foreign tenders for cables required for a year, particularly, if possible, from users to whom cables have been supplied in this country and abroad.

Russian Orders for Czecho-Slovakia.

It is stated that the Soviet Trading Delegation in Czecho-Slovakia has placed orders with the firm of Kern and Company for the supply of boiler fittings and turbo-generators for the Schatur station, near Moscow, of the value of $973,000. Moreover, the Witkowitz works in Freistadt is in course of executing a Russian order for dynamo sheets of the value of 5,500,000 Czech crowns.

Trade Announcements.

Mr. P. C. CURTIS, late manager of Radio Components, Ltd., has now taken over the outside representation in the London area of Lectro Linx, Ltd. ("Clix" specialities).

The address of the registered office and works of Messrs. WOOTTON & CO., LTD., is now Alma Works, Ponders End, Middlesex. The telephone number remains unchanged, *viz.*, Enfield 0700. The new premises are on up-to-date lines, and the floor area is practically four times that of the old premises.

Mr. NORMAN S. ROSE, of Rose Bros., has been appointed representative for Manchester and district of Messrs. J. J. Eastick & Sons. Mr. R. H. BULL, also of Rose Bros., has been appointed an additional representative for London and district.

Messrs. HOOK & WILLIS, LTD., 74, Goding Street, Vauxhall, S.E.11, agents for several important manufacturers of electrical and radio specialities, are taking a new office and showrooms at 29, Ely Place, Holborn, E.C.1.

The CESTRIAN ELECTRICAL CO. has opened premises at 138, Northgate Street, Chester, and asks for manufacturers' catalogues.

Mr. ALEC JAUNDRILL, late with Mr. W. Cawley, has commenced business as an electrical contractor and radio expert at 21, Duke Street, St. Helens, Lancs.

The BOTHWELL ELECTRIC CO. has opened a new branch at 647, Govan Road, Glasgow, which will be known as the "Govan Electric Shop"; it will cater for wireless. The branch will be under the control of Mr. H. H. Epstein, who will be glad to receive catalogues, &c., from manufacturers and agents.

The Brighton office of CRYSELCO, LTD., at 35, Duke Street, Brighton, is being moved to-day (Friday) to larger premises in the same building.

The offices of the NORWICH ELECTRIC TRAMWAYS CO. have been removed to Silver Road, Norwich.

Mr. A. HOLMES, late of the General Electric Co., Ltd., has been appointed assistant to Mr. Ernest Pickbourn, chief representative for the Electrical Equipment & Carbon Co., Ltd., for the East Midland counties and East Anglia.

Mr. A. R. CLEMITSON has left Messrs. Clarke, Chapman and Co., Ltd., with whom he has been for 30 years, to take up consulting and agency work, with offices at Milburn House, Newcastle-on-Tyne. He will represent nine engineering companies dealing with steam-raising plant, &c.

New Catalogues and Lists.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—Catalogues No. Z.120, containing fully-illustrated details of improved "Zed" fuses and distribution boxes of many patterns; and No. 232, advertising, with particulars, the company's radio valves. Both lists are priced. Also Catalogue 170, a profusely illustrated price-list of "Siemens" shop window lighting equipment and accessories.

THE HOTPOINT ELECTRIC APPLIANCE CO., LTD., 24, Newman Street, Oxford Street, W.1.—A coloured showcard (20 in. by 30 in.), advertising the company's electric washing machine.

MESSRS. HUGH J. SCOTT & CO. (BELFAST), LTD., Volt Works, Ravenhill Avenue, Belfast.—A revised trade price list of "Scott" induction motors and control gear.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Lists P.218, dealing with aluminium wire and stranded conductors; and P.220, containing a complete list of the company's manufactures, which cover a wide field.

DRAKE & GORHAM WHOLESALE, LTD., 67, Long Acre, W.C.2.—Pamphlet No. 434, containing illustrations and prices of electric fires, irons, kettles, toasters, grillers, cookers, water heaters, &c., of many makes.

MR. ALAN WRIGHT, 124, Chancery Lane, W.C.2.—A priced, illustrated leaflet dealing with the "Inventum" piano heater.

THE TUNGSTONE ACCUMULATOR CO., LTD., St. Bride's House, Salisbury Square, E.C.4.—An illustrated and priced booklet advertising "Tungstone" batteries for automobile and radio use, with instructions for care and use.

MESSRS. PRITCHETT & GOLD and E.P.S. Co., LTD. (incorporating Peto & Radford), 50, Grosvenor Gardens, S.W.1.—A coloured poster (30 in. by 20 in.), advertising Peto & Radford accumulators for automobiles, aviation, and radio.

MESSRS. MCBAIN BROS., LTD., Castle Engineering Works, Tweedmouth, Berwick-on-Tweed.—An illustrated booklet dealing very fully with the company's "Freelight" windmill electricity-generating plant.

MESSRS. S. G. BROWN, LTD., North Acton.—The "Brown Budget" for August, containing illustrated articles and notes on various phases of the company's business.

THE QUASI-ARC CO., LTD., 15, Grosvenor Gardens, S.W.1.—A "Plant Circular," illustrating and describing the company's electric welding equipment.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Supply List No. 128/6, dealing with "Silverstone" glassware for lighting purposes. Many examples are illustrated, and a number of the illustrations are beautifully coloured. Prices are given.

DUGDILLS PATENTS, Hazel Grove, Stockport.—A card bearing illustrations and prices of jointed lighting fittings of many patterns. Also a list of "repeat-order" customers.

THE STANTON IRONWORKS CO., LTD., near Nottingham.—A stock list of "Stanton Hume" concrete pipes.

Bankruptcy Proceedings.

J. EADE, trading as "James Eade & Son," 48, New Road, Skewen, Glam., electrical contractor.—The receiving order in this matter was made recently on debtor's own petition. The statement of affairs shows liabilities of £914, while the assets are estimated at £352, from which preferential claims of £46 have to be deducted, leaving net assets of £306—a deficiency of £609. The first meeting of the creditors was held recently at the Official Receiver's offices, Swansea. The following are creditors:—

	£		£
British Insulated Cables, Ltd.	71	Bankers	108
Edison Swan Electric Co., Ltd.	72	Sutton & Bridgman ...	83
Falk, Stadelmann & Co., Ltd.	92	United Agencies (E. Holbrook & Co.)	27
		Westward Electrical Co.	236
		Wholesale Fittings Co. ...	37

H. PADGETT and A. NICHOLSON, trading as "Padgett & Co.," 218, Spring Bank, and 10, Beverley Road, Hull, electrical and radio engineers.—Last day for receipt of proofs for dividend September 10th. Trustee, Mr. J. E. D. Stickney, Official Receiver, 37, Scale Lane, Hull.

C. E. F. PARKER, Privett Road, Gosport, Hants., electrical engineer.—Trustee, Mr. H. Ashton, Official Receiver, 87, High Street, Portsmouth, released August 18th.

H. H. ATKINSON, 33, Princess Avenue, Old Trafford, Manchester, electrical engineer.—Trustee, Mr. J. G. Gibson, Senior Official Receiver, Byrom Street, Manchester, released August 16th.

J. J. WHITTAKER, formerly trading with another as "Busfield & Co.," 6, Wildfield Street, Burnley, electrical engineers.—Bankrupt's discharge suspended for one year from July 28th.

A. J. CULLUM, 34, Mount Pleasant, Diss, Norfolk, motor and electrical engineer.—First and final dividend of 2s. 4d. in the £, payable August 29th, at 9, Arcade Street, Ipswich.

Company Liquidations.

SLOGASIGNS, LTD., 51, Bethnal Green Road, E.—The restriction put upon the use of electricity by the Government owing to the coal and general strikes of last year is given as the chief reason for the liquidation of this company, other factors being insufficient capital, the necessity for further experiments with the advertising devices, lack of knowledge and bad management. A compulsory winding up order was made against the company in November, 1926, under which accounts have been filed showing liabilities of £1,594, against assets valued at £542 and a total deficiency of £6,117 with regard to contributories, the issued capital being returned at £5,000. The company was formed as a private company in October, 1925, to acquire certain patents for advertising devices, and to manufacture, &c., under such patents. The liquidation remains in the hands of the Official Receiver.

FLADBURY ELECTRIC LIGHT & POWER CO., LTD.—General meeting of members September 27th, at the house of Mr. J. W. Wagstaff, Fladbury, to hear an account of the winding up from the liquidator, Mr W. G. Day.

SERENADA MANUFACTURING CO., LTD.—Meetings of creditors and contributories to-day (Friday) at 33 Carey Street, W.C.2.

F. A. BROWN & CO., LTD.—Winding up voluntarily. Liquidator: Mr. A. Grierson, 21, Spring Gardens, Manchester.

RADIO CABINETS, LTD.—A meeting of members is called for September 26th at 54, New Broad Street, E.C.2, to hear an account of the winding up from the liquidator, Mr. O. A. Hibbert.

REFLEX RADIO CO., LTD.—Last day for receipt of proofs for dividend September 12th. Liquidator: Mr. H. E. Burgess, Senior Official Receiver, 33, Carey Street, W.C.2.

Dissolution of Partnership.

HAYNES & FLEESON, electrical and mechanical engineers.—Messrs. A. J. Haynes and H. W. Fleeson have dissolved partnership. Mr. Haynes will attend to debts and continue the business.

Private Arrangements.

JOHN GLICKMAN, trading as the Manchester Radio Service Co., Great Ducie Street, Manchester.—The creditors interested herein were called together on August 26th, in Manchester, when a statement of affairs was presented which showed liabilities of £2,773, of which £2,195 was due to the trade. The net assets were £405, leaving a deficiency of £2,368. It was reported that the debtor commenced business in 1923 with £200 which he borrowed. He had not kept a full set of books of account, but his net profit for the first year was about £350, and for the second year £436. For the 13 months to December, 1926, his turnover was £18,258, on

which there was a gross profit of £664 and a net loss of £264. Debtor attributed the loss to bad trade and the holding up of goods from abroad during the strike. It was intimated that he was prepared to make a guaranteed offer of 5s. in the £, payable by three equal instalments over four months. This offer and a further offer of 7s. 6d. in the £, payable over nine months, were refused, and it is understood that the debtor will file his own petition. The following are creditors:—

	£		£
Benjamin Electric, Ltd.	55	Chloride Electrical Storage Co., Ltd. ...	100
B.T.-H. Co.	68	Hunt, A. H., Ltd. ...	69
General Electric Co., Ltd.	230	Ebeling, E. O.	125
Metro-Vick Supplies, Ltd.	59	Cole, E. K., Ltd. ...	42
Manchester Radio Co.	71	Clarke, H., & Co. ...	36
Hirst, Ibbotson & Taylor, Ltd.	95	Siemens & English Electric Lamp Co., Ltd. ...	261
Marconiphone Co., Ltd.	193	Kasimar Baumgartin ...	63
Mullard Radio Valve Co., Ltd.	409	Cassell, Mrs.	118
Edison Swan Electric Co., Ltd.	46	Cossor, A. C.	262
		Bankers	249
		Liverpool & County Discount Co.	210

For Sale.

Offers are invited by Electricity Distribution of North Wales and District, Ltd., for one watertight petrol-paraffin four-cylinder, 46-b.h.p., 33-kVA set, and one four-cylinder Coventry Simplex petrol engine.

Henry J. Shaw has been instructed to sell by auction at 13, High Holborn, W.C.1, on September 7th, various trade stocks of electrical and wireless goods and materials. (See our advertisement pages to-day.)

Book Notices.

To celebrate the Volta Centenary, a special number of our contemporary, *L'Energia Elettrica*, has been published at the sole cost of the Unione Nazionale Fascista Industrie Elettriche, which is handing over the gross profits from sales to the Committee for the Volta Commemoration. It is a remarkably fine production, comprising 325 pages, admirably printed on hand-made paper; on the front cover is a portrait of Alessandro Volta, and inside are found illustrations of his apparatus and of houses in which he lived. An article by Prof. Luigi Volta, of the University of Turin, describes the scientific achievements of Volta, and is followed by 20 other essays, the authors of which include the most eminent names in Italian electrical science; these articles treat of as many different aspects of electrical science and industry, and in fact the work records the state of development attained by electro-technology as the outcome of the discoveries of Volta. The whole was compiled under the direction of Prof. O. M. Corbino as editor, who also contributed one of the articles. The special issue is sold, for the benefit of the Commemoration Committee, at L.70 (per foreign post L.80), from the offices of *L'Energia Elettrica*, 31, Foro Bonaparte, Milan (109).

"The Annual Report of the National Institute for the Blind, 1926-27."—This record of the activities of the Institute during the past year is both pathetic and interesting. Many instances are quoted of the way in which blind people are "helped to help themselves," becoming as useful citizens as the majority of those who are in possession of their eyesight.

"Science Abstracts," A and B. Vol. XXX. Part 8. August 25th, 1927. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Actinotherapy for General Practitioners," by H. G. Falkner. Pp. x+152; figs. 36. London: Baillière, Tindall & Cox. Price 7s. 6d. net.

The revised edition (1927) of the Post Office "Handbook for Wireless Telegraph Operators" has been issued by H.M. Stationery Office, price 9d., post free 10½d.

Creditors' Meeting.

CHARLESWORTH, PEEBLES & Co.—A meeting of creditors of this firm was held on August 30th, when a statement of affairs was presented and proposals were put forward. Statements of claims should be sent to Messrs. Dixon, Wilson, Tubbs and Co., 24, Basinghall Street, E.C.2.

Unemployment.

During the week ended August 15th there was a fall of 2,640 in the total of registered unemployed. The figure was 1,022,100, as compared with 1,024,740 on August 8th, and with 1,580,520 on August 16th, 1926, when the total was swollen by unemployment due to the coal dispute.

An "Exide" Campaign.

The CHLORIDE ELECTRICAL STORAGE CO., LTD., is arranging an "Exide Week" from September 19th to 24th. A part of the scheme, to stimulate the interest of "Exide" agents, is a window-dressing competition, for which the company offers material in a specially-produced pamphlet. A great deal of additional national advertising is being undertaken for the occasion.

Recent Contracts.

The RELAY AUTOMATIC TELEPHONE CO., LTD., has recently secured in open tender two important railway contracts. The London and North-Eastern Railway has placed a contract with the company to replace the existing manual telephone system at King's Cross and Liverpool Street, and to link up Marylebone with the new automatic system. The installation will be of the "Relay" private automatic branch exchange type, and will follow the standard G.P.O. practice of giving conversations from the manual and automatic exchanges over the same lines.

The other contract was placed by the Great Indian Peninsula Railway for the automatisation of its system into one network of inter-connected exchanges; some of the exchanges on this scheme are several hundred miles apart. Both installations are already in course of manufacture and will be installed and brought into service within the next few months.

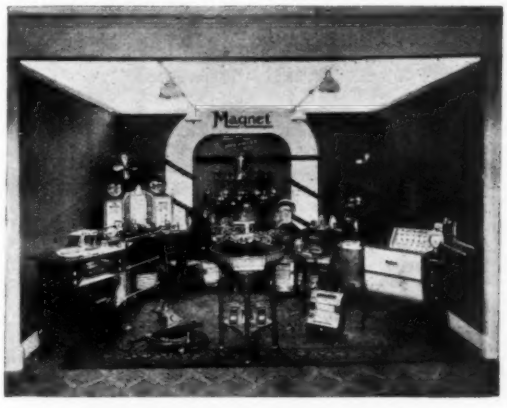
The holiday season is usually regarded as one in which orders may be expected to fall off, but during the last month notable orders for abroad were received by the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., amounting in value to over half a million pounds. These included equipment for the New South Wales railway electrification and the Leopoldina Railway, Brazil; turbo-generator sets for Calcutta, the Punjab, and the State Commissioners of Victoria; transformers for Shanghai; and switchgear for Melbourne.

Spanish Import Duty on Accumulators.

The Spanish import duty on storage batteries weighing less than 25 kg. (55 lb.) per element, and plates for these weighing less than 1½ kg. (3.3 lb.) has recently been increased from 0.6 to 1.50 gold pesetas per kg.

A Labour-Saving Exhibition.

During August Messrs. William Whiteley, Ltd., ran a labour-saving exhibition in which electrical appliances were naturally prominent. The accompanying illustration shows a collection of "Magnet" devices arranged for the display by the General Electric Co., Ltd. The exhibition attracted as many people as the company's July sales.



"Magnet" Appliances at Whiteley's.

Prices of Raw Materials.

In their lead market report dated August 27th, Messrs. James Forster & Co. stated:—"Business throughout the week has been chiefly of a professional character, consumers continuing their policy of buying only on actual requirements. . . . There is certainly nothing in the position of the metal to induce the slightest optimism. It is well known that a huge stock exists in this country, and the quantity coming in shows no signs of abatement. . . . Increasing shipments from America to this country are much in evidence this month. . . . News has been received on the Metal Exchange, from Melbourne, of a statement made by the directors of the Broken Hill Proprietary Company, and of Block 14, to the effect that unless considerable improvement in metal prices takes place they will be reluctantly compelled to suspend operations within a month owing to the heavy loss on working of late. No doubt this announcement will cause a temporary rally in prices, but it will take a great deal more than the closing of Block 14 to permanently help values."

Messrs. Charles Clifford & Son, Ltd., report that the price of phosphor bronze wire was advanced from 1s. 3¼d. to 1s. 3½d per lb. on August 4th. This alteration should have appeared in our issue of August 12th.

Messrs. F. Smith & Co. report, August 30th:—Copper (electrolytic) bars, £62 5s., 5s. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £72 5s., 5s. dec.; ditto ditto h.c. wire, no change.

Messrs. James & Shakespeare report, August 30th:—No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £24, 5s. dec.

Messrs. Edward Till & Co. report, August 30th:—India-rubber, Para fine, 1s. 3¼d., ¼d. dec.

Lighting and Power Notes.

Australia. — CANBERRA. — According to the *Industrial Australian and Mining Standard*, the chief engineer of the Federal Capital Commission recently switched on the current from the new power-house at Canberra, installed by the Australian General Electric Co. Before the commission finally takes over the new plant, further trials will be conducted. The steam turbo-alternator has a capacity of 1,500 kW, and was constructed by the British Thomson-Houston Co., Ltd. The plant will be capable of generating 9,000,000 kWh a year, though this year the commission expects to supply only 4,500,000 kWh. Next year the electrical supply branch estimates that there will be a demand for 6,500,000 kWh. In addition, the commission intends to supplement the supply from Burrinjuck hydro-electric station, and already a preliminary survey of the probable route of the transmission line has been made.

Clitheroe.—SUPPLY FOR GASWORKS.—The question of obtaining a supply of electricity for power purposes at the gasworks is under consideration by a sub-committee of the Corporation.

Clyde Valley.—PRICE REDUCTION.—The Clyde Valley Electrical Power Co. and its associate company, the Strathclyde Electricity Supply Co., Ltd., have notified their lighting consumers whose rates were advanced 10 per cent., due to the coal strike that from October 1st next this increase will be withdrawn.

Continental.—GERMANY.—According to the *Zeitschrift des Oesterreichische Ingenieur und Architekten Verein*, what is claimed to be the most powerful steam turbine so far constructed in the world has lately been completed by the Maschinenfabrik Thyssen & Co., of Mulheim-am-Ruhr, Germany. The turbine, which has been built for the new power station at Bohlen, Leipzig, of the Sachsische Werke Gesellschaft, has a capacity of 32,000 kVA at 3,000 r.p.m.

GREECE.—According to a recent issue of the *Bulletin* of the Banque d'Athenes, practically all the towns in Greece are now provided with an electricity supply. There are eighty power stations in the country, and during last year Government authorisation was given for 38 new ones in different localities, bringing the total up to nearly 120, the total capacity of which is estimated at about 36,800 h.p. No definite information is available as to the output, but the Athens Bank authorities estimate this for last year at 40 million kWh, of which the Phalerc plant was responsible for 26 million kWh, the Salonica power station for 6,600,000 kWh, and the Valo station for 580,000 kWh.

FRANCE.—The French Government has given its approval to the establishment of a large new hydro-electric power station at Krems, on the Rhine, in the Haut Rhin province.

AUSTRIA.—The plant at the Simmering power station, near Vienna, is being increased by the addition of one 25,000-kVA steam turbo-generator designed to run at a speed of 3,000 r.p.m. It is at present in course of construction at the works of the Austrian Siemens-Schuckert Co.

ITALY.—Among the concessions recently granted by the Government for the establishment of plants to utilise water power, are the following:—The Società Elettrica Bergamasca (4,346 h.p.), on the River Brembo, in the province of Bergamo; the Società Elettrica Bresciana (52,616 h.p.), on the River Oglio; and the Societa Elettricità Alta Italia (3,500 h.p.), on the River Stura at Germagnano, Turin province.

RUSSIA.—The Riga correspondent of *The Times* reports that the Soviet authorities in Moscow have published a notice to the effect that during winter it will be necessary to introduce restrictions in the supply of electricity "owing to the general deterioration of plant and the inability sufficiently to increase the power station." Factories, also, will begin work an hour earlier and finish earlier to prevent a simultaneous demand for both power and lighting.

Glasgow.—PROGRESS DURING JUNE AND JULY.—The Corporation electricity manager reports that in June and July under the "paid on completion and under three years' scheme" 106 houses were wired, making the total to date 3,769. Under the 10 years' hire-purchase scheme the number increased by 234, making the total to date 820. The number of applications during June and July for the hire of appliances was 237, making the total to date 15,327.

ELECTRICITY SUPPLY.—At a meeting of the Sub-Committee on Propaganda, the manager submitted a proposal for the hiring of 17-gallon and 2-gallon water heaters for domestic purposes, and the sub-committee recommended that he be authorised to purchase 20 heaters of each type.

The manager is to report further on a proposal for an extension of the hire-purchase wiring scheme to larger houses.

The sub-committee has recommended that the rental for the new type of cookers be increased from 10s. to 20s. per annum after the first year's hire.

DALMARNOCK EXTENSIONS.—It was recently reported to the Electricity Committee that the Central Electricity Board had agreed to amend the Central Scotland electricity scheme by increasing the capacity of Dalmarnock power station by two sets of 40,000-kW capacity, to be installed for operation by the winters of 1932-33 and 1935-36, instead of by two sets of 25,000-kW capacity under the original scheme.

Irish Free State.—KINGSTOWN.—At a recent meeting of the Urban District Council, Mr. Devitt, replying to criticisms of the failure to supply electricity to portions of the township, said that the plant at the power station was working to full capacity, and the Government would not allow the Council to install any additional plant. The additional energy required would have to be obtained through the Shannon scheme, and the Council was not in a position to guarantee the supply until the Shannon Power Board was functioning.

London.—ISLINGTON.—The Borough Council is to reduce the charges for electricity by 15 per cent.

Nantwich.—INSTITUTION SUPPLY.—The Board of Guardians is to have electric lighting installed at the Institution at an estimated capital cost of £1,600. Electricity will be supplied by a local company at a standing charge of £6 per kW of maximum demand per annum, with a minimum payment of £100 a year, plus 1¼d. per kWh for electricity consumed for all purposes.

Preston.—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (engineer: Mr. J. F. Simpson) for the year ended March 31st last records a total income of £171,868, as compared with £130,986 in the preceding year. Working expenses increased from £72,154 to £100,298, the increased cost of fuel being approximately £20,000, and the gross profit was therefore £71,570, as against £58,832, to which was added revenue from other sources, making a total of £79,202. Capital charges absorbed £78,088, and capital outlay charged to revenue amounted to £2,335, leaving a net deficit of £1,221, as compared with a loss of £15,316 in 1925-26. The capital expenditure during the year amounted to £206,027, and included £75,247 for plant and machinery at Ribble power station, and £47,894 for mains and services. There was a considerable increase in the sales of electrical energy, from 15,250,029 to 26,969,060 kWh. The total sales in 1923 amounted to only 4,305,091 kWh. The maximum supply demanded rose from 8,400 to 12,000 kW, and the average price obtained per kWh fell from 2.061d. to 1.52d. An additional 12,500-kW turbo-alternator was installed during the year, making the total installed capacity 37,500 kW. Work on the 33,000-V main transmission line between Preston and Blackpool is proceeding, and it is expected that supplies will be available to meet the winter load. The 33,000-V main transmission line between Preston and Blackburn was completed and put into commission.

TRANSMISSION CABLE.—Work on the transmission cable from the Corporation power station to Blackpool has been interfered with by the weather, but it is intended to have the first test on September 9th.

Ruskington.—STREET LIGHTING.—The Urban District Council has decided to adopt electricity for street lighting, and has accepted the offer of the local company for lighting 35 lamps for six months each year for seven years, at approximately 46s. per lamp.

South Africa.—WITBANK.—An electricity supply for the district was recently formally inaugurated by the Mayoress

Southend-on-Sea.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £56,000 for the provision of plant, h.p. mains, &c., in connection with the linking-up scheme.

South-East Lancashire Electricity Advisory Board.—ANNUAL REPORT.—We have received a copy of the report of the proceedings of the Board for the year ended March 31st last. During the year bulk supply contracts between the Lancashire Electric Power Co. and Rochdale Corporation, and the Corporations of Salford and Eccles were approved. Sanction was given to plant extensions at Ashton-under-Lyne, Altrincham, Barton, Bury, and Macclesfield. Applications for extensions at Bury, and further plant at Altrincham were made, but not finally considered. Approval was given to the construction of 33,000-V transmission lines by Manchester Corporation and the Lancashire Electric Power Co., and Special Orders granted to Rochdale Corporation, Barton and Urmston Electricity Board, and the Lancashire Electric Power Co., were supported by the Board. The consumption of electricity in the area increased from 708,069,467 to 729,617,774 kWh, and energy sold per head of population in 1926, based upon the 1921 Census, amounted to 257 kWh. Based on the estimated population for the year in question, the energy sold amounted to 242 kWh per head. The cost of administration for the year amounted to £2,433, which, when distributed over the kWh sold, yields a figure of .00080d. per kWh, as compared with .00071d. in the preceding year.

MANCHESTER TRANSMISSION LINES.—The Engineering Advisory Committee has recommended the Board to approve the laying of mains by Manchester Corporation, for which application for sanction to a loan of £252,450 has been made.

BILLINGE AND ORRELL.—An application by Wigan Corporation for a Special Order to supply electricity in the urban districts has been submitted to the Board for approval. The estimated cost of the scheme is £21,376.

ALTRINCHAM.—Altrincham Electric Supply, Ltd., has applied for sanction to amend its application for extensions to its power station by substituting one 3,000-kW, two-phase, 80-

cycle, turbo-alternator for the 6,000-kW set originally proposed. The matter has been adjourned.

PADIHAM-ROCHDALE TRANSMISSION LINE.—The Lancashire Electric Power Co. has applied for consent to establish a third 33,000-V transmission line from Padiham to Rochdale, and the application has been passed on to the Board for approval.

BURY.—The Board has been recommended to approve the installation by Bury Corporation of one 10,000-kW set.

STOCKPORT.—In connection with the extensions to the Stockport Corporation's power station, the Committee has recommended the Board to approve the substitution of a 20,000-kW set for the 10,000-kW set which has already been approved.

The minutes of the proceedings of the Engineering Advisory Committee have been approved and adopted by the Board.

Salford.—YEAR'S WORKING.—We have received the report of Mr. S. J. Watson (now chief engineer to the London and Home Counties Joint Electricity Authority) on the working of the Corporation electricity undertaking for the year ended March 31st last. The total revenue amounted to £291,217, as compared with £287,899 for the preceding year. As a result of the coal dispute, working expenses, including bulk supply purchased, increased from £151,364 to £189,259, leaving a gross profit of £101,958, as against £136,536, to which was added interest on investments of £5,750, and an unemployment grant of £13,998, making a total of £121,706 available. After deducting interest and sinking fund contributions, there was a net surplus of £12,149, as compared with £44,236 in 1925-26. The capital expenditure during the year amounted to £112,214, the chief items being £51,473 for additions, &c., at Agecroft power station, and £34,494 for h.p. and l.p. mains. The sales of electrical energy increased from 49,776,217 to 53,333,470 kWh, and the maximum load from 22,384 to 23,200 kW. The average price obtained per kWh fell from 1.37d. to 1.282d. During the year 23 miles of additional mains were laid, bringing the total up to 282. Nine additional transformer sub-stations were connected to the 6,600-V system, and two stations disconnected, making a total of 65 sub-stations with a capacity of 24,640 kVA of static transformers for a.c. supply and 18,235 kW of rotary convertors for d.c. supply. The number of electric cookers let out on hire increased by 400, bringing the total connected to 553.

Special Orders.—Application has been made to the Electricity Commissioners by Sir William Claude Fawcett for a Special Order authorising him to supply electricity in the rural district of Stokesley, and part of the rural district of Middlesbrough.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Spalding Urban District Council to supply electricity in the rural district of Crowland, and part of the rural district of Peterborough; the Shoeburyness Urban District Council to supply in its area; the West Midlands Joint Electricity Authority to purchase and use land for the erection of a generating station at Buildwas; the County of London Electric Supply Co,. Ltd., and the North Metropolitan Electric Power Supply Co., to give a reciprocal bulk supply; and the Tonbridge Urban District Council to supply electricity in the parish of Hildenborough, and part of the parish of Leigh.

Spenborough.—ELECTRICITY IN SMALL HOUSES.—The Urban District Council has decided to supply electricity to Council houses on the Heaton site at a flat rate of 6d. per kWh, less 2½ per cent. discount for prompt payment of accounts, with meter rents; or at a fixed annual charge on rateable value of 12½ per cent., plus 3½d. per kWh, with a discount of 2½ per cent.

Stirling.—YEAR'S WORKING.—The accounts of the burgh electricity undertaking (engineer: Mr. W. B. Murray) for the year ended May 15th last show a total income of £17,051, and working expenditure of £12,820, leaving a gross profit of £4,231. After payment of capital charges, &c., there was a net deficit of £604. The sales of electricity increased from 1,078,425 to 1,196,579 kWh, and the maximum supply demanded from 678 to 803 kW.

Stourport.—POWER STATION EXTENSIONS.—In consequence of the rapidly growing demand for electricity in the West Midlands, the Shropshire, Worcestershire and Staffordshire Electric Power Co. has decided to extend the new power station at Stourport. The extensions, which are to be commenced at an early date, will provide accommodation for a further 25,000-h.p. turbo-alternator and auxiliary plant. This will bring the plant capacity of the station up to 75,000 h.p., and with the Smethwick power house, the company will have a total capacity of 115,000 h.p. available for service.

Welshpool. — OVERHEAD LINES. — The Montgomeryshire County Council has given its consent to the Electricity Distribution of North Wales and District, Ltd., to erect overhead lines in certain streets at Welshpool for a period of five years, at the end of which the question of overhead lines will be reconsidered.

Tramway and Railway Notes.

Australia.—MELBOURNE.—A statement showing the revenue of the metropolitan tramway system of Melbourne for the year ended June 30th last has been issued by the chairman of the Tramways Board. According to the *Industrial Australian and Mining Standard*, the total revenue for the year was £2,500,000, as compared with £2,142,234 in the previous year. The increase of about £358,000 was due partly to the increased revenue from the higher fares which became operative last year, and partly to the increased traffic due to the extension of the tramway system. It is interesting to note that this increase has been made, to a large extent, at the expense of the Railways Department. Since the electrification of the Elsternwick and the Windsor lines, the competition with the railways has resulted in a loss of railway revenue at the rate of £19,000 a year in respect of each service, while the connection of the Malvern Road and High Street lines to the St. Kilda Road service, and the consequent routing of these trams into the city, has involved the Railways Department in an additional loss of £20,000.

Chile.—RAILWAY ELECTRIFICATION.—The Chilean railway authorities consider that the most important work to be done in connection with the State lines is the extension of the system of electrification to the Central Railway leading from Santiago to Puerto Montt, a distance of 670 miles, and the line from the capital to Puerto San Antonio, about 70 miles in length, while another matter to receive immediate attention is the long-projected line from Santiago to Valparaiso *via* Casablanca, affording a shorter route between the capital and chief seaport than that which now exists *via* Llia Llia Junction. According to *The Times Trade and Engineering Supplement*, the Public Works Department is now considering plans for the electrification of the second zone of the State Railways—*i.e.*, the portion between Santiago and Talca—and also the San Antonio line, while the project for the construction of a Transandine railway in the north to connect Antofagasta with the Argentine railway system at Salta is likewise to be undertaken.

Continental.—THE TYROL.—The work of electrifying the section of railway between Rosenheim and Kufstein having been completed, electric trains are now being run between Regensburg, Munich, Kufstein, and Innsbruck.

CZECHO-SLOVAKIA.—The Prague correspondent of *The Times* reports that the municipality of Prague has entered into negotiations with an American syndicate for the construction of an underground railway, at an estimated cost of £6,000,000.

Dearne Valley.—EXTENSION OF TIME.—The Minister of Transport has extended the time for the completion of work under the Dearne District Light Railways Order, 1915, to June 24th, 1928.

London.—TUBE "HOLD-UP."—A breakdown occurred on the Central London Railway on August 29th, due to the failure of a train at the Post Office station. Westbound traffic was delayed for 45 minutes, and the westbound service between Liverpool Street and the British Museum station was suspended until the defective train was removed from the track.

Southern Railway.—NEW LINE.—Plans have been completed for the construction of a new line between Wimbledon and Sutton, and if they are approved by the directors of the company at their meeting in October, work will begin shortly afterwards. This extension was sanctioned by Parliament 17 years ago, but owing to the war and other reasons the scheme has been delayed. The L.C.C. proposes to erect a town for 30,000 people in the Morden district, and this, with other rapid building developments, has brought the scheme forward. The date on which the line must be completed, unless the company obtains an extension of time, is June 29th, 1930, but it is hoped that it will be opened before then. This will largely depend on the engineering difficulties encountered as the work proceeds. It will be necessary to build 21 bridges and construct a number of embankments. All the necessary land has been acquired except a small part which is the subject of negotiation.

Telegraph and Telephone Notes.

Australia.—TRANS-OCEANIC TELEPHONY.—Commenting on the item on the agenda paper for the International Wireless Conference at Washington, in November, regarding the possibility of establishing systems of radio-telephony between the principal countries of the world, the Postmaster-General said recently that preparations for establishing a service of wireless-telephony between Australia and Great Britain were already in hand; he expected that the service would be in operation in

a few months. It is estimated that the fee for a wireless-telephone conversation of three minutes between Australia and London would be about £15.—*Reuter's Trade Service* (Sydney).

Brazil.—WIRELESS SERVICE.—The Minister of Communications has approved a concession for an international and national wireless service. The sites of the various stations are left to the discretion of the Government's advisers. The Administration stipulates for a 75 per cent. reduction on foreign and 50 per cent. on national messages dispatched by the Departments of Public Works and Transportation, Marine, and War. All operators are to be of Brazilian birth, and the installation must be completed within a year of the official approval of plans. The Government has also authorised the Companhia Telefónica Rio Grandense to operate wireless stations at Sao Paulo, Florianopolis, Puerto Alegre, and Corumba. A station, independent of the new concession, has lately been opened at Manás (State of Amazonas).—*Reuter's Trade Service* (Rio de Janeiro).

Colombia.—NEW STATIONS.—The Government has concluded a contract with a German firm of electrical engineers for the erection of three wireless stations at Honda, Neiva, and Ocana respectively. Plant and apparatus for a fourth high-power station, capable of communicating with both home and foreign stations, are being shipped shortly from Germany. The four installations (which will be supplementary to those at Barranquilla, Pasto, Manizales, and Bucaramanga) will be erected under the superintendence of German engineers.—*Reuter's Trade Service* (Bogota).

India.—"BEAM" RADIO-TELEGRAPHY.—Marconi's Wireless Telegraph Co., Ltd., informs us that the British Post Office authorities have issued the preliminary certificate of acceptance of the "beam" radio-telegraph stations which have been established to conduct a high-speed service between India and England.

CHEAPER TELEGRAMS.—*Reuter's* Agency learns that the Eastern Telegraph Co., Ltd., has announced the reduction of its rate for ordinary telegrams between Great Britain and India, Burma, and Ceylon to 1s. 5d. per word from September 1st next, with proportionate reductions for the cheaper classes of traffic. The company will also introduce on the same date week-end telegrams between the same countries at a rate of 3½d. per word, subject to a minimum charge of 5s. 5d. for 20 words.

Salvador.—TELEGRAPHS AND TELEPHONES.—The Central American Republic of Salvador possesses efficient services of telephone and telegraph communication. The telephone system comprises more than 2,650 miles of line (of which 85 miles was erected in 1926) and 275 exchanges. The telegraph system embraces 1,000 miles of line and 250 telegraph stations. Twenty-five new offices with combined services were opened during 1926. In the capital, the telephone and telegraph lines are laid underground, and messages are transmitted through a new central telegraph and telephone office. The wireless telegraph station in San Salvador has been renovated recently, and new short-wave equipment installed, which will make it possible to send communications at all hours.

Ships' Radio Apparatus.—DIRECTION FINDERS.—The general increase in the use of wireless direction finders is clearly demonstrated by the steady flow of orders from shipowners for new installations, not only for new ships or for single vessels, but in the majority of cases for a number of installations for whole fleets. Among the most recent installations of Marconi direction finders are those for 15 ships owned by the Hain Steamship Co., Ltd., of Cardiff, six ships owned by Messrs. Stanley & John Thompson, Ltd., six owned by Messrs. G. Heyn & Sons, of Belfast, and further installations for Messrs. Donaldson Brothers, Furness, Withy & Co., Ltd., Elders & Fyffes, Ltd., the China and Southern Trading Co., Ltd., and the J. Constantine Steamship Line, Ltd., of Middlesbrough.

THE MARCONI AUTO ALARM.—Over two hundred British ships are now being fitted with the new Marconi auto-alarm apparatus, which was described last week. Among the shipowners who have placed orders with the Marconi International Marine Communication Co., Ltd., are the Royal Mail Steam Packet Co., Messrs. T. & J. Brocklebank, Messrs. F. C. Strick & Co., Ltd., Messrs. Elders & Fyffes, Ltd., the Glen Line Services, the Sun Shipping Co., Ltd., Lambert Brothers, Ltd., Ellerman Lines, Clan Line, Andrew Weir & Co., and T. & J. Harrison.

Transatlantic Telephony.—LOWER FEES NEEDED.—A statement by the New York Trust Co. on the development of communication shows that about 60 per cent. of the messages sent across the Atlantic Ocean by telephone are of a social character. This fact is taken to indicate that, while the transatlantic telephone rates remain at their present high figure, the telegraph cables will continue to handle the bulk of the business messages between Europe and the United States.

Turkey.—ERICSSON CONCESSION.—Economic relations between Sweden and Turkey are being steadily developed, the latest step being the conclusion of an agreement between the Swedish L.M. Ericsson telephone company and the Turkish Government for the construction of a telephone system in Turkey. A Turkish company will be founded with a share capital of 6,000,000 Swiss francs, half of the shares being subscribed for by the L.M. Ericsson Co. and the other half by the Turkish Government; the capital will later be increased. The company will obtain a 40-year concession for the construction of lines between the most important Turkish towns, Angora-Constantinople, Smyrna-Constantinople, Smyrna-Angora, &c., and local telephone systems in some towns, not including Constantinople, where the concession is held by an Anglo-French combine. Agreements for the construction by the L.M. Ericsson Co. of local systems at Smyrna and Angora have previously been concluded. The material for the work will be supplied by the L.M. Ericsson Co., which will also provide engineers. The agreement is subject to ratification by the Turkish National Assembly, which meets in October.—*Reuter's Trade Service* (Stockholm).

United States.—RADIO-TELEGRAPHY.—The Mackay companies have acquired the wireless system of the Federal Telegraph Company, a Californian concern, the present service of which is limited to point-to-point and ship-to-shore transmission, but it is intended, says *The Times*, so to expand the system as to provide a wireless supplement to the existing cable service. The long-wave arc system will be employed for foreign transmission, while for inland work a short-wave will be used.

Radio Notes.

Australia.—NEW STATION.—The New South Wales Cabinet has approved of the establishment by the State of an "A"-grade broadcasting system. The proposal includes the erection of a central 15-kilowatt station, in or near Sydney, and six relay, or repeater, stations in the country. The total cost would be about £30,000. The stations will re-broadcast telephony, or Morse, and when not used for Government purposes could be used for re-broadcasting programmes. No land lines will be used for communication between the central station and the others.

WAVE-LENGTHS.—Giving evidence before the Wireless Commission recently, Mr. E. G. Beard, consulting engineer to the Sydney broadcasting station (2GB), outlined a scheme for allocating Australian wave-lengths which, he asserted, would make inter-State reception easy. He suggested that the wave band of 150 to 550 metres should be divided into six equal parts, one part to be allotted to each State. Two waves, each 30 kilo-cycles from the centre of the band, should be allotted, one to each "A"-class station. Two waves, of 10 kilo-cycles from the centre of the band, should be allotted, one to each "A"-station, as relay link waves. The "B" stations should be allotted waves starting with those 20 kilo-cycles from the nearest "A" station, and 10 kilo-cycles apart, to the limits of the band.—*Reuter's Trade Service* (Sydney).

LICENCES.—Of every 30 persons in the Commonwealth, one is the holder of a wireless licence. During the 12 months ended June 30th the number of licences in the Commonwealth increased by 97,079, making the grand total 215,139. The number granted and cancelled in June and the number in force at the end of the month, according to figures made available by the Director of Postal Services (Mr. H. P. Brown), were as follows:—

State	New Issues.	Cancellations.	In force.	Per 100 of population.
New South Wales ...	3,395	771	59,880	2.55
Victoria	7,106	2,177	118,965	6.95
Queensland	1,139	177	33,249	2.63
South Australia ...	930	200	16,791	2.96
Western Australia ...	123	93	3,903	1.03
Tasmania	112	1	2,351	1.14
Commonwealth totals	11,805	3,359	225,139	3.68

Bolivia.—NEW STATION.—The Bolivian Government has arranged with a private contractor for the installation of a broadcasting station at La Paz, the first of its kind in Bolivia, with a power of 1,000 watts and a minimum radius of 3,000 km. (The international radio call letters assigned to Bolivia are CPA-CPZ.) The Government reserves the right to install radio-telephonic stations at any time. The La Paz station will be used for broadcasting Government reports, market quotations, official time, Congress proceedings, &c. Five minutes of each hour only may be employed for broadcasting advertising matter. The contract is for five years, and on its expiration the broadcasting station will become State property. The concessionaire, who undertakes to establish a weather bureau, send out meteorological reports and supply a daily service of general news, musical programmes and educational lectures, will retain all subscriptions. An initial registration fee of 5 bolivianos (7s. 6d.) and an annual licence fee of 36 bolivianos will be charged to users of the broadcasting service.—*Reuter's Trade Service* (La Paz).

India.—CALCUTTA.—A *Reuter* message from Calcutta states that Sir Stanley Jackson, Governor of Bengal, opened the Calcutta station of the Indian Broadcasting Company on August 26th.

Japan.—BROADCASTING CORPORATION.—A new national organisation has been formed under the name of the "Broadcasting Corporation of Japan." It has amalgamated the three previous organisations at Tokio, Osaka and Nagoya. The country is now divided into territorial broadcasting divisions:

Kanto (Eastern), Tokai (Central) and Kansai (Western), to which are being added: Kyushu (Southern Island), Chugoku (Central States), Tohoku (North Eastern), and Hokkaido (Northern Island). The old Tokio Broadcasting Bureau has taken the name of Kanto Division, but is still better known as the Tokio central broadcasting station, says *World Radio*, which explains that in accordance with the five-year plan of the new Corporation a new 10-kilowatt station is being built in the prefecture of Saitama, about 20 miles north of the city of Tokio, to replace the present 1-kW station at Atagoyama in the city, which will be converted into a studio connected with Saitama. It is hoped that the new station will begin transmissions next spring. The total number of licensed listeners in Japan is 370,000, of whom 237,000 belong to the Kanto Division.

Denmark.—NEW STATION.—The high-power station at Gisselöre, near Kalundborg, has been carrying out tests, and was expected to be officially inaugurated on August 29th.

New Zealand.—WAVELENGTH REVISION.—To minimise interference from Australian stations and the new high-power station at Wellington, the following new wave-lengths have been allocated to New Zealand stations: IYA, 333 metres; 2YA, 420 metres, 3YA, 306 metres; and 4YA, 363 metres.—*Reuter's Trade Service.*

United States.—NEW CHAIN OF STATIONS.—A chain of 15 American and Canadian broadcasting stations, forming the second largest radio chain in the world, will be subject to British direction almost immediately as a result of an important scheme ratified in London during the week-end. Contracts, states the *Daily Telegraph*, have been signed between the American Telephone and Telegraph Co. and the Columbia Graphophone Co., whereby the Columbia Co. will open 15 stations, covering North America from the Atlantic coast to the Rocky Mountains, on September 4th, and broadcast its own musical programmes, in direct competition with the National Broadcasting Co.

I.B. CORPORATION *v.* F. R. COMMISSION.—Of great interest is the action of the International Broadcast Corporation in withdrawing the suit it had begun against the Federal Radio Commission in the Court of Appeals of the District of Columbia. The suit was brought for two purposes: to obtain for station WGL in New York City a better broadcast channel, and to test the legality of the 1927 Radio Act. *World Radio* says that the suit has been withdrawn, not because the Corporation believed the position it had taken to be a wrong one, but because it felt that whatever difficulties now exist can be adjusted by the co-operation of the broadcasting companies under the supervision of the Commission. It is also pointed out that should the Radio Act be declared unconstitutional at this time, conditions of chaos would be created.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Belgium.—September 7th. Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels. Three lots of telephone cable for Ghent, Lokeren, and Renaix, and five lots for Verviers, Liége, Spa, Pepinster, and Aubel. Specifications Cahier des Charges Spécial Nos. 3-257 and 3-269) for 12 fr. each.

ST. GILLES, BRUSSELS.—September 20th. Municipal Council. Supply of 150 3-amp., 600 5-amp., and 100 10-amp. ampere-hour meters, and five 20-amp. watt-hour meters, all for 220-V circuits. Particulars (Cahier des Charges) for 5 fr. from Service de l'Electricité, 40 Rue de Bethléem, St. Gilles, Brussels.

Birmingham.—September 10th. Board of Guardians. Installation of electric heating at the Union Offices, Edmund Street.

Bulgaria. — PLOVDIV. — September 12th. Town Council. Supply of materials for and erection of a power station.—*Reuter's Trade Service* (Sofia).

Croydon.—September 5th. Electricity Department. One vertical spindle motor-driven borehole pump. (August 26th.)

September 6th. 20,000 tons of coal for use on chain-grate mechanical stokers. (August 19th.)

Dundee.—September 16th. Electricity Department. Supply and delivery of d.c. and a.c. house service meters. (See this issue.)

Eccles.—September 12th. Health Committee. Electric lighting, wiring and fittings for 75 houses to be erected in Gaskell Road. Specification and form of tender from the Borough Electrical Engineer, Electricity Works, Cawdor Street, Patricroft.

Egypt.—CAIRO.—October 1st. State Railways, Telegraphs and Telephones. Supply of underground cables, from £E6,000 to £E6,300. Firms should communicate direct with the Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, S.W.1.—*Reuter's Trade Service* (Cairo).

October 12th. Egyptian Ministry of Public Works. Four Diesel alternator groups and accessories for the Atf power station. (A.X. 5028.)*

October 26th. 7,500-kW thermal power station for Belgas. (B.X. 3748.)*

Grimsby. — September 5th. Electricity Department. Supply of p.i.l.c., l.p. cables for one year.

September 20th. One 500-kW convertor, transformer, l.p. switchgear, cable work, &c. (August 26th.)

Heston and Isleworth.—September 19th. Electricity Department. Two 1,000 kW motor convertors, transformer, and the switchgear. (See this issue.)

India.—September 16th. India Store Department. Three 40-kW oil-engine generating sets, with cables and accessories. (August 19th.)

September 13th. Two 30-kW oil engine d.c. generating sets, complete with cables and accessories. (August 26th.)

Irish Free State.—DUBLIN.—September 17th. Electricity Department. Single-phase and three-phase meters. (See this issue.)

Kirkcaldy.—September 24th. Town Council. E.h.p. switchgear, transformers, and equipment for static substations. (See this issue.)

London.—ST. MARYLEBONE.—September 19th. Board of Guardians. Installation of electric cables, &c., at the Hospital. (See this issue.)

Luxemburg.—September 19th. Following the recent decision of the Chamber of Deputies, the Government of the Grand Duchy of Luxemburg is inviting fresh offers for the establishment and working of an electricity distribution system throughout the country. Tenders are to be sent to the Directeur-Général des Travaux Publics, Luxemburg. Particulars (Cahier des Charges) can be obtained for 75 francs from the Bureau d'Etudes et de Construction pour l'Electrification du Grand Duché de Luxemburg, 3, Avenue de la Liberté, Luxemburg.

New Zealand.—WELLINGTON.—October 11th. Public Works Stores Department. Supply and delivery of 1,000—50,000-V insulators. (B.X. 3742.)*

October 25th. 50-kV switchgear and steelwork for Waikato. (B.X. 3685-6-7-8.)* 10,000-kVA transformers for Waikato. (B.X. 3604.)*

Oldham.—September 12th. Board of Guardians. Electric lamps and fittings. Particulars from F. W. Fletcher, clerk to Guardians, Union Offices.

Pontypridd.—September 12th. Urban District Council. One 500-kW rotary convertor, transformer, and necessary switchgear. (August 26th.)

South Africa.—DURBAN.—October 6th. South African Railways and Harbours. 200-V switchboard for the Durban workshops. (B.X. 3739.)*

September 23rd. Municipal Council. Eight 500-kVA, single-phase transformers for Scott connection. Two 300-kVA, 3-phase transformers. Twenty 100-kVA, single-phase transformers.

September 30th. Four e.h.p. switch-panels.

October 14th. Six e.h.p. switch-cubicles.

CAPE TOWN.—September 21st. Town Council. Supply and delivery at the Dock Road power station stores of electric light poles, cross arms, insulators, binding wire, &c. Particulars from the city electrical engineer.

September 21st. Electricity Department. Cables. (B.X. 3751.)*

JOHANNESBURG.—September 26th. Municipal Council. Street lighting material. (B.X. 3752.)*

Stafford. — September 26th. Staffordshire Education Committee. Installation of electric light and power, King Edward VI School. (See this issue.)

Stourbridge.—September 13th. Stourbridge and District Water Board. Pumping machinery, including a 5-kW, d.c. dynamo, 220 V, with switchboard and fittings. Particulars from G. Plant Deeley, consulting engineer, 13, Church Street, Stourbridge.

Stockport.—September 19th. Electricity Committee. One 20,000-kW turbo-alternator and surface condensing plant. (August 26th.)

Swindon.—September 10th. Corporation. Three 2,000-kW and two 500-kW rotary convertors with transformers; and six static transformers of from 500 to 2,000-kVA capacity. (August 26th.)

Tilbury.—September 22nd. Urban District Council. Electricity meters for 12 months. Carcassing of houses on the Council's housing estate, complete for lighting and cooking, and also for the installation of electric cookers in the houses. (August 19th.)

Wallasey.—September 17th. Electricity Department. Supply and erection of one 50-ton overhead electric travelling crane at Limekiln Lane power station. (August 19th.)

Warrington.—September 5th. Electricity Department. Twelve months' supply of earthenware conduits. (August 26th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Glasgow.—Corporation. Accepted:—
Two electric trucks, &c. (£581).—Electric Vehicles, Ltd.
Motor-generator (£116 15s.).—Edmiston, Brown & Co., Ltd.
Electrical installation, Plantation Registration Office.—Charles Maguire.
Electricity Committee. Recommended:—
Four 400-kVA transformers (£350 each) and six 200-kVA transformers (£220 each).—Bruce, Peebles & Co., Ltd.
Two 250-kVA frequency changers (£1,280 each).—Electric Construction Co., Ltd.
Tramways Committee. Accepted:—
V.i.r. cable.—Enfield Cable Works, Ltd.
D.c.c. wire.—British Insulated Cables, Ltd., and W. T. Henley's Telegraph Works Co., Ltd.
Recommended:—
G.E. 58 armature coils.—Manchester Armature Repair Co.
L.c. cables.—Standard Telephones & Cables, Ltd.
Subway haulage rope.—Wrights Ropes, Ltd.; British Ropes, Ltd.
Material for new and reconstructed cars:—
Motors.—General Electric Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Controllers.—Metropolitan-Vickers Electric Co., Ltd.; Electric Control, Ltd.
Magnetic brakes.—Electro-Mechanical Brake Co., Ltd.
Air brakes.—Consolidated Brake & Engineering Co., Ltd. (G. D. Peters & Co.).
Bogie trucks.—Kilmarnock Engineering Co., Ltd.
Axles.—Glasgow Railway Engineering Co.
Wheels and tires.—North British Steel Foundry Co.; John Baker & Co., Ltd.
Roller bearings.—British Bock Bearings, Ltd.; Skefko Ball Bearing Co., Ltd.; Hoffman Manufacturing Co., Ltd.

Irish Free State.—Controller of Stores (Posts and Telegraphs). Accepted during June and July:—
Ebonite bases.—United Ebonite Mfrs.
Cables.—Deutsche Telephonwerke; Fernand Espir; Dennis and Co.; Routledge (Dublin); Standard Telephones and Cables, Ltd.; and V. Zorn (Dublin).
Coils, various.—Standard Telephones & Cables, Ltd.; Telephone Mfg. Co., Ltd.; Ericsson Telephones, Ltd.
Fuses (telegraph and telephone).—Phœnix Telephone and Electric Works, Ltd.
Generators.—Sterling Telephone & Electric Co., Ltd.; Telephone Mfg Co., Ltd.
Keys, various.—International Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.
Automatic telephones (parts).—Standard Telephones and Cables, Ltd.
Terminals.—Cook Electric Co. (Chicago)
Wire, various.—Bain & Co.; Dennis & Co.; Main & Co.; Pirelli, Ltd.; Ryland Bros.; Whitecross Co.
Irish Electrician.

London.—Air Ministry. Accepted:—
Lamps.—Siemens Electric Lamps & Supplies, Ltd.
Great Western Railway Co. Accepted:—
Supply and erection of 12-ton electric crane for Bristol.—Joseph Booth & Bros.
Laying of cables, &c., for track signalling between Paddington and Old Oak Common.—Hackbridge Cable Co., Ltd.
30-cwt. electric lift for the Newport (High Street) goods station.—Wadsworth & Sons, Ltd.
Southern Railway.
Six months' contract for electric lamps.—British Thomson-Houston Co., Ltd.

Oldham.—Electricity Committee. Accepted:—
Coal-handling plant for new generating station.—Babcock & Wilcox, Ltd.

Tynemouth.—Electricity Committee. Accepted:—
Cable (£111).—Connollys (Blackley), Ltd.

Waterford.—Council. Accepted:—
Transformer kiosks (£800).—John Hearne & Co.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

"MOFFAT" electric cookers.
Machines for plucking feathers from dead poultry.

Notes.

L.C.C. Tramways Finance.

In the August *Journal* of the Municipal Tramways and Transport Association, the general secretary (Mr. J. Beckett) criticises the accountancy methods adopted by the Highways Committee of the London County Council in connection with its tramways. He shows that by debiting renewal charges against revenue the apparent "deficit" is greatly exaggerated, making the undertaking appear to be losing heavily when this is not the case. The deficiency of £275,159 shown in the last accounts is arrived at after charging renewals, and if these charges were excluded the actual deficiency would be only £24,416. It is also noted that the rates on the permanent way amounted to £31,200 last year. Then, Mr. Beckett considers that the way in which the capital debt is being redeemed is not sufficiently stressed in the existing system of presenting accounts; by means of sinking funds 47 per cent. of the original debt has been wiped out. Other points are also dealt with, and the conclusion is reached that if it is essential that the present standard form should be adhered to, the Committee should publish, in addition, a statement of accounts strictly comparable with those of commercial undertakings. If this were done, Mr. Beckett thinks that the results shown would be such as would satisfy many front-rank commercial concerns.

Ultra-violet Rays for Miners.

Five cheery pit-lads from Sherwood Colliery, Mansfield, Nottinghamshire, recently set out to spend a fortnight or three weeks in a chalet 6,000 ft. up the Swiss mountains. There each morning they will play games without any clothes on so as to get the full value from the ultra-violet rays of the sunlight. Lieut.-Col. G. S. Hutchinson, F.R.G.S., who is in charge of the boys, and is a member of the Committee of the Swiss Alpine Club and of the New Health Society, explained to the *Daily Mail* that the idea of the trip was to test the health value of ultra-violet light. The boys were measured in detail before leaving London. Every day the record of their development will be charted, and psychological alterations will also be noted. The trip is a preliminary to an experiment which is to be begun at the Sherwood Colliery in October. At the pit-head is now being erected by the owners, the New Hucknall Colliery Company, an up-to-date clinic, which will include artificial sunlight lamps, to enable miners and their children to benefit by ultra-violet rays. A medical officer will keep records, and a report will be submitted to the Safety in Mines Research Board. The New Health Society, with the National Institute of Industrial Psychology and the Sunlight League, are interesting themselves in the experiment. It is believed that by the use of ultra-violet rays much may be done to improve the general standard of health among miners, and that diseases believed to be mainly due to the deprivation of light, may be checked.

Austrian Fire Brigade and Radio Communication.

A number of the motor vehicles belonging to the fire brigade authorities of Vienna have lately been equipped with radio receiving and transmitting apparatus, to enable communication to be maintained between the scenes of fires and headquarters.

The Dating and Sealing of Patents.

The following is a summary of the conclusions of the Committee appointed by the Board of Trade to consider whether or not any change is desirable in the British system of dating (1) patents applied for under the International Patent Convention, and (2) other patents:—The British system of antedating Convention patents to the date of the application in the country of origin carries out more completely than any other system both the letter and the spirit of Article 4 of the Convention of 1911. No change is in itself desirable in the British system of dating either class of patents. Nevertheless, since nearly all the Convention countries favour an amendment to the Convention which would exclude the period of priority from the life of the patent, it would be desirable to meet the wishes of those countries in so far as this could be done without serious detriment to British interests, and if by such a concession Britain could obtain in return concessions from those countries. If an arrangement of this kind could be come to, the British practice might be altered so as to allow the fixed portion of the monopoly period—in the case of all patents, whether under the Convention or otherwise—to run from the date of the filing of the complete specification, no change being made in the present practice of dating patents. Such a concession on the part of Britain should not be made unless as part of a bargain—the concession on the other side being the abolition of the rights of third parties and rights of personal possession arising in such countries in the interval between the original application and the Convention application, and, possibly, certain other things which British delegates to international conferences have tried unsuccessfully to obtain.

If Britain makes this change in the date of the commencement of the fixed portion of the monopoly period, the requirement that specifications with Convention applications should be published on acceptance or at the expiration of 12 months from the date of the original application—whichever might be the earlier—should be abolished. If Britain makes this change with regard to the monopoly period, the time allowed for filing the complete specification should be the same in both classes of applications, namely, 12 months after the date of the application in the country of origin in the case of Convention applications—as is the law now—and 12 months (with no extension) after the date of application, with provisional specification, in this country in the case of ordinary applications.

The Committee did not come to any conclusion as to whether the term of the patent—from the commencement of the fixed portion of the monopoly period—should be fifteen years or sixteen years; it suggests that further evidence on this point should be taken. The evidence which has been taken points to sixteen years as being the preferable term.

Women's Engineering Society.

The fifth annual conference of the Women's Engineering Society is to be held at the Shipping, Engineering and Machinery Exhibition, Olympia, on September 15th to 17th next, when the members will stay at Crosby Hall, Cheyne Walk, Chelsea, S.W. The programme includes the presentation of and discussion on papers and a number of interesting visits. On September 16th a discussion on the "Relative importance of commercial and technical engineering under present-day conditions" will be opened by Miss E. M. Kennedy, for the commercial side, and Miss Norah M. Jeans, for the technical side. On the 17th, at Crosby Hall, Miss Iris Cummins, B.E., B.Sc.(Eng.), will deliver a paper on "Water Power and the Electrification of the Irish Free State."

Compensated Three-phase Motors.

Ordinary three-phase induction motors without special devices for increasing the slip have pronounced shunt characteristics, and are thus unsuitable for driving rolling mills, for instance; in order to be able to utilise the kinetic energy of such plant for meeting the sudden variations in load, and thus prevent excessive fluctuations of current in the system, the characteristics of the driving motor must be such that the speed of the driving motor drops when the load increases. For this purpose Messrs. Oerlikon, Ltd., have designed a compensated three-phase motor, consisting of an induction motor working in conjunction with a small frequency changer, coupled to it directly or through gears. The frequency changer, which is provided with a compensating winding, supplies the counter-e.m.f. for neutralising the excess slip pressure when the slip is increased and also permits of the operation of the motor at a leading power factor.

The frequency changer is built on the lines of an induction motor, with the difference that it has an armature similar to that of a rotary convertor, with commutator and slip-rings. A three-phase brush equipment is provided on the commutator side, and is connected in series with the compensating winding on the stator. The compensating winding serves to neutralise the ampere-turns of the armature winding, due to the rotor current of the induction motor. Owing to the provision of this compensating winding, in order to obtain a counter-e.m.f. in the frequency changer, it is only necessary to supply a small amount of magnetising energy at the slip-rings of the frequency changer.

Low-temperature Carbonisation Plant.

According to the *Gas World*, the McEwen-Runge plant in Milwaukee, U.S.A., is capable of treating 210 tons of coal per day. Mr. Ralph L. Brown, chief engineer of the low-temperature carbonisation department of the International Combustion Engineering Corporation of New York, who read a paper dealing with the subject at the annual meeting of the Canadian Gas Association, is reported to have said that the plant has been developed to such a stage that it has been proved basically and fundamentally correct, and its success is assured. A feature of the McEwen-Runge plant is the height to which it rises. The enclosing house is 140 ft. high, in ten floors, with automatic lift. The plant is fed with pulverised coal, and the resulting coke is used for industrial purposes. There are two retorts, one above the other, each 28 ft. high and 8 ft. 3 in. in diameter. The pulverised coal passes successively through both retorts, which are heated internally partly by gas burned in combustion chambers and partly by gas from the "make," first heated in cooling the outcoming coke. The top retort has an average temperature of about 500 deg. F., and the bottom retort an average of 1,200 deg. F. The equipment control apparatus is all located in one place, the instrument room. Both retorts are very fully equipped with recording and indicating pyrometers, pressure gauges, &c., which register in the instrument room. The primary and secondary coal feeders are provided with recording tachometers that show the throughput of coal at any time. The quantity of gas flowing to the holder, from the holder, and to both primary and secondary burners, is recorded continually on meters located in the instrument room. The plant operation is thus brought under the control of one man stationed in the instrument room, who may see, by a glance at the instrument board, what all the plant conditions are, and may make any changes that are desired. Automatic temperature controls are being installed on the gas burners, so that there should be very little chance for the temperatures to vary to any great extent. The operation of the plant is so simplified that only a very small amount of labour is required. The fuel used may be a coking or non-coking coal, and, if the yield of by-products should warrant, it may even be a lignite.

A Large Waste-Heat Installation.

According to *Power*, a waste-heat installation designed to develop 5,250 kVA is nearing completion at the Florida Portland Cement Co.'s works at Tampa, U.S.A. Steam is supplied by three 9,000-sq. ft. Edge Moor boilers, to which waste heat from the kilns is delivered by 150-h.p. motor-driven fans. The kiln housing is designed so that all waste gases may be passed into the stack or used by any or all of the boilers. The steam conditions are 225 lb./sq. in. and 150 deg. superheat. The steam will supply two Allis-Chalmers reaction turbines of 1,250 and 4,000 kVA output capacities, respectively. The lay-out of the plant is based on an annual coal consumption in the cement production of 125,000 tons.

Metal Trades Benevolent Society.

The seventy-ninth anniversary festival of the Royal Metal Trades Pension and Benevolent Society will be held at the Hotel Cecil, London, on Tuesday, October 11th, 1927; for the first time, ladies will be present. The chairman will be Sir Alfred Mond, Bt., P.C., M.P. Tickets for the festival can be obtained from Mr. W. Farmer, 195, Upper Thames Street, E.C.4, price 15s. each.

Special Libraries' Conference.

It is expected that some 200 organisations will be represented at the fourth conference of the Association of Special Libraries and Information Bureaux which is to be held at Trinity College, Cambridge, during the week-end September 23rd-26th. Following a reception by Sir J. J. Thomson, O.M., Sir Geoffrey Butler, K.B.E., will deliver the presidential address, whilst among the many experts who will read papers are Sir Henry Lyons (director, the Science Museum), Mr. A. E. Overton (Principal, Board of Trade), and Sir Richard Gregory (editor of *Nature*). The subjects to be discussed at the conference include such topics as the recent report of the Public Libraries Committee, Co-operation between Libraries, and Book Selection in Science and Technology. Sectional meetings will be held on information and statistics in commerce and industry, on patent classification and on information bureau questions. The conference is open to all interested, whether members of the Association or not. A copy of the detailed programme and other particulars can be obtained from the Secretary, A.S.L. I.B., 38, Bloomsbury Square, London, W.C.1.

A Well-meant Appeal.

The following letter was received by Messrs. Holophane, Ltd., in reply to one of their electrical advertisements, from a correspondent in Gambia:—

"Dear Sirs,—As I was reading a book called 'The Ideal Home,' I saw in it a booklet called 'Descriptive Booklet,' so I say that this 'Ideal Home Magazine' is very good, then I say that I must write for it to-day to make good used.

"Without obligation, thanks,

"I am, Yours faithfully, Friend,

"XXX."

"Please very urgent, I want to know and read about the book."

Tidal Power at Pagham.

Hydro-power plant installed at Pagham Harbour, near Bognor, is to be utilised for generating electrical power, but it also has potentialities as an irrigator. The action of the plant is simple, says the *Financial Times*, which explains that round the periphery of a revolving drum are a number of radial arms, with swivelling vanes hanging from the lower side. The vanes are suspended in the water, and as the ingoing stream pushes against them on one side the wheel rotates. As the vanes are pivoted, the onward current forces them to "feather" and skim over the surface when they come in contact with the flow on the reverse side of rotation. Although the tide alters its course in ebb and flow, the wheel does not reverse its motion; as a result the complication of reversing gear is dispensed with.

Educational.

THE POLYTECHNIC, REGENT STREET, W.1.—Electrical Engineering Department. The 1927-28 session commences on September 26th; enrolments from September 14th to September 23rd. Prospectuses and full particulars from the Director of Education.

NORTHAMPTON POLYTECHNIC INSTITUTE.—Evening classes in engineering, fuel technology, and metallurgy. Session commences September 26th. Full-time courses in engineering, ophthalmic optics, &c. Prospectuses from Mr. S. C. Laws, principal, St. John Street, E.C.1.

BOROUGH POLYTECHNIC INSTITUTE.—Part-time day courses and evening courses in electrical engineering, and special courses on Saturday mornings. (See our advertisement pages to-day.)

Electric-furnace Hardening Tests.

We have received a copy of the report on hardness and impact tests which have been carried out by the Metallurgical Dejartment of the Cadillac Motor Car Co., U.S.A., on some transmission gears manufactured by that company. Some of the gears were hardened in a Wild-Barfield electromagnetic furnace, and some in American electric furnaces, using the dilatometer, an instrument for indicating the critical temperature of the steel by expansion or dilatation. Neither lot of gears showed distortion beyond the limits allowed, .001 in. inside diameter. The hardness of the Wild-Barfield tested gears was Rockwell C58, and of those hardened in the American furnaces Rockwell C59. The results of the impact tests on the W-B treated gears showed maximum, minimum, and average values of 2,365, 665 and 1,820 ft.-lb., energy absorbed, respectively. The equivalent results for the tests on the gears dealt with in the American apparatus were 1,615, 312 and 1,130 ft. lb., energy absorbed, respectively. Some Cadillac production gears were tested for comparison, and they broke at 1,395 maximum, 275 minimum, and 936 average, ft.-lb. The report concludes that while an explanation of the superiority of the W-B tested apparatus could not be given, the matter was worth investigation in view of the excellent quality of the work turned out.

The Almeida Accumulator.

We have received the following communication with regard to the Almeida cell:—

"That 'there is nothing new under the sun' is an old saying and possibly this may apply to the Almeida battery equally with many other inventions.

"The English patent is taken out under the name of Count de Mieres and is numbered 268,047, being accepted on March 28th, 1927, the application date being December 25th, 1925, which accounts for your not being able to trace the patent under the name of Almeida.

"The account you give from the E.T.Z. as to the results of experiments being carried out by a Continental firm agree, with details sent me privately from abroad. It is quite correct that details of similar accumulators are published in *Les Accumulateurs Electriques* by Jumau in 1907, but one has to go many years further back to find what I consider the basic patent. Being interested in experimental work with accumulators employing the halogens, I have made a very exhaustive search through the Patent Abridgments as far back as 1884, and have found that in 1888 a patent was taken out by Pierre Anatole Fichet and Albert Nodon, who used an electrolyte consisting of a combination of the halogens (without which it is impossible to obtain such a high voltage) as specifically claimed in the new battery, these being the chlorides of bromine, chlorides of iodine, bromides of iodine, and they further give details of precautions that have to be taken so that these compounds are stable when formed.

"It is well known that the chloride of silver cell is reversible, and the Almeida cell, in my opinion, when charged is a chloride-of-silver cell, with an electrolyte of chloride of bromine.

"There are other patents taken out in this country using the halogens in some form or other, but none by an Englishman as far as I could find.

"It does not appear that the use of silver at the positive pole is essential for the working of the cell, but as the two haloids of silver formed are practically insoluble in water it acts, one might say, as a reservoir first for the bromine ions and later for the chlorine ions.

"From experiments I have carried out, chlorine gas is given off at the end of charge, and not only is this exceedingly unpleasant but as the capacity of the battery is dependent on the concentration of the electrolyte, the capacity of the battery is diminished owing to the loss of chlorine.

"Local action on open circuit and the difficulty in obtaining a smooth adherent deposit of zinc on the negative plate during charge will probably outweigh other advantages such as reduction in weight, in the same way as they have prevented the commercial operation of lead-zinc cells." M.I.E.E.

Sunderland Electricity Extensions.

At the official inauguration of the extensions to the Sunderland Corporation electricity undertaking, described elsewhere in this issue, on August 24th, Sir John Snell, chairman, Electricity Commission, unveiled a tablet in the Hylton Road generating station, and Councillors T. Speeding and A. S. Bainbridge, chairman and vice-chairman of the Electricity Committee, respectively, started the two new 10,000-kW turbo-alternators. Speaking at a celebration luncheon after the ceremony, Sir John said it was largely owing to the experience he gained at Sunderland that he owed what measure of success had fallen to him in later years. All parties in the State, he said, took the view that electricity was indispensable in modern life and that the very fullest use must be made of it in our industries, including, he hoped, agriculture. Since 1919 a phenomenal development had taken place in the country's electricity supply, and this development was now being accelerated in spite of adverse conditions. To reach an output of even only 500 kWh per head of the population per annum would require an expenditure of 250 to 300 millions sterling. In the humblest dwellings of Switzerland and parts of Norway and Sweden, electricity was looked upon as an indispensable agent in the house. Why should not the same advantages be given to our homes, irrespective of classes? Sir John complimented his successor, Mr. Blackman, highly upon his skill in modernising the plant at Sunderland and carrying through, with his staff, the latest extensions. Mr. Blackman had brought down the fuel consumption from 4 lb. per kWh, at which it stood when he took charge in 1906, to 2 lb. 4 oz. per kWh, and during the last three months, since the new machinery had been in operation, he had further reduced the consumption to 2 lb. per kWh. He had no doubt the Council would reap the fruits of its enterprise by reduced costs of production and lessened cost to the consumer, which would bring about increased consumption.

Shop Window Lighting.

A lecture demonstration on "Recent developments in shop-window lighting" was given in the demonstration theatre of Messrs. Holophane, Ltd., Westminster, on August 30th. Mr. L. M. Tye, who gave a talk illustrated by lantern slides on "Modern Shop Lighting," said that a recent exhaustive survey of existing methods of lighting in retail shops in London and other cities gave evidence of the need for improvement on a large scale. In many cases bare lamps were suspended at eye-level, making it impossible to observe the contents of the window owing to "glare." Window "pull" depended upon the art and originality of the window dresser, working in collaboration with the lighting engineer. The most effective illumination of an article, whether it was drapery, a motor car or a joint of meat, presented a special problem, in the solution of which both art and science played their part. Whilst general lighting of the window by concealed reflectors answered most requirements, the use of colour screens and "spot" lights might now be applied with great spectacular effect.

Mr. R. Gillespie Williams lectured on "Colour Lighting for Shop Windows and Interiors." The application of colour to shop lighting attracted the attention and held the interest of the buying public. By means of the Holophane system, involving the use of the three primary colours, red, blue and green, practically every known colour could be obtained.

The New Rating Provisions for Business Premises.

In the penultimate paragraph of the article by Mr. W. Eric Jackson bearing the above title, which appeared in our last issue, reference was made to "railway lines and trucks." The last word should have been "tracks."

An Electric Welding Set.

A recent production of the H. E. W. Syndicate, Ltd., is an electric welding outfit which is designed primarily for use on board ship. This embodies the Harms patent system for maintaining a constant load on the generator, independent of the arc, rendering the voltage constant and the arc stable. The attainment of this lies in the provision of a resistance equal to that of the normal welding circuit, through which the current is shunted when the arc is broken. An automatic magnetic switch is employed to cut out the resistance when the arc is made. The resistance elements are mounted in a steel framing, with a perforated sheet-iron cover, which is assembled as a unit with the switch box, so that the whole is portable and particularly suitable for use on board ship. The elements are claimed to be rustproof and capable of being used for long periods without undue heating. Renewable arcing contacts on the magnetic switch are employed to prevent burning of the main contacts. By virtue of the magnetic switch, pressures in excess of 35 volts may be employed. The weight of the apparatus is 330 lb., and its dimensions are 21 in. by 33 in. by 28 in. The only accessories required are the connecting and welding cables, eye shields, electrode holders and electrodes.

Education Broadcast.

The B.B.C. programme and syllabus of "Transmissions to Schools" has been issued; it covers the transmissions from all stations for the Christmas term, September 23rd to December 16th, 1927, and gives a provisional programme for the coming school year. An effort is being made to adapt the lessons still more to the special needs of the medium, and to effect a closer co-operation between school teachers and their colleagues at the microphone.

Appointments Vacant.

Wireless operators required by the Government of Mauritius for three years. Sub-station attendant for Torquay Corporation. Sales engineer and clerk required for the showroom of the Sevenoaks and District Electricity Co., Ltd. (See our advertisement pages to-day.)

E.A.W. Activities.

At the request of the Head Mistresses' Committee, which works in co-operation with the Ministry of Labour, the director of the Electrical Association for Women recently joined a Committee to explore the possibilities of training secondary school girls for openings in connection with the use and development of domestic electricity. It was felt that this training should provide a definite course in simple electrical knowledge, in addition to the training in domestic science. A syllabus of electrical knowledge has been drawn up, with the assistance of Mr. J. W. Beauchamp, director of the Electrical Development Association, and approved by the Committee. A first experimental course in "Electrical Housecraft" is being held at the Chelsea Polytechnic, and a second one will commence at the Battersea Polytechnic at the beginning of 1928. As far as possible, the E.A.W. will keep a register of trained women, so that engineers and manufacturers wanting women assistants will be able to apply direct to the Association.

The Velocity of Sound in Liquids.

The blinking of a red neon light is an index by which physicists can measure accurately for the first time the speed of sound waves in liquids; this has been accomplished by Drs. John C. Hubbard and Alfred L. Loomis, working in the latter's private laboratory at Tuxedo Park, N.Y. In a new apparatus, called a "Sonic Interferometer," waves similar to sound waves, but vibrating many times too rapidly to be detected by the ear, are used. A disk cut from a crystal of quartz, like that used in modern radio stations to keep the wave-length constant, but much larger, furnishes the waves. This disk is placed between two metal plates which are connected to a vacuum tube, also like that used in radio broadcasting. The tube furnishes a rapidly oscillating electric current. While two kilowatts was used to run the tubes in earlier experiments, the sonic interferometer uses only 50 watts. When the current is turned on, the quartz crystal oscillates, giving off waves which vibrate from 200,000 to 400,000 times a second, and are from an eighth to five sixteenths of an inch in length in a liquid medium. The human ear cannot hear sounds which are in faster vibration than about 20,000 a second.

A vessel containing the liquid to be tested is placed over the vibrating crystal and the waves travel up through it. Immersed in liquid, parallel to the quartz plate, is a metal disk which can be moved up or down by a very small amount. At certain positions of the upper disk the waves from the quartz are reflected back so that they are exactly in step with the waves coming up from the bottom. In such positions the little neon lamp goes out. By measuring the position of the upper disk, the lengths of the waves can be determined to within a twenty-five-hundredth of an inch. The number of vibrations per second of the crystal is known, and so the speed of the sound waves can be measured with an extremely high degree of precision.

As a result of their investigations, Dr. Hubbard and Dr. Loomis find that sound waves travel through pure water at a temperature of 60 degrees Fahrenheit with a speed of 4,850 feet per second. If the water contains one half of one per cent. of salt, the speed increases to 5,050 feet per second. Increasing the temperature of the pure water to 77 degrees increases the speed to almost the same figure. From previous measurements, the speed of sound in air has been determined at about 1,100 feet per second.—*Science.*

Indian Licences for Wireless.

Our Indian correspondent informs us that, under the Indian Telegraph Act, the establishment, maintenance, and working of "telegraphs" (which includes wireless telegraphy and wireless telephony) in British India is illegal, except in accordance with a licence issued under that Act, and the Act specifies heavy penalities for the use of apparatus in British India without a licence. There are several kinds of licences: if it is desired only to receive broadcasting, the correct form of licence is the "broadcast receiver licence," which can be obtained by any one from any head post office in British India on the presentation of a completed application form and the licensing fee of Rs. 10. A broadcast receiver licence is valid for 11 months after the month of issue, and a fresh licence is necessary to continue to establish, maintain, or work wireless apparatus after that date. A separate licence is required for each station or receiving set.

Licences to use wireless for other purposes, such as transmitting or experimental reception, are issued only after investigation, and application has to be made to the Director-General of Posts and Telegraphs (Wireless Branch), Simla. The above licences entitle the licensee to use a wireless set in the manner indicated. They do not entitle the licensee to import wireless apparatus into British India, for which a separate "import licence" is necessary under the Sea Customs Act. Import licences are also issued by the Director-General of Posts and Telegraphs (Wireless Branch), Simla; the fee is Rs. 10 per annum, and the licence is valid until the end of the year in which it is issued.

For the convenience of passengers to India who are bringing a single receiver with them, arrangements have been made by which the Customs officers at the principal ports, *viz.*, Bombay, Calcutta, Madras, Karachi, Rangoon, and Dhanuskhodi, issue "temporary permits" in certain circumstances. A temporary permit will only cover one wireless receiver (or its component parts) accompanying a passenger as personal baggage. Application should be made on a form which can be obtained from the Customs officer. It must be accompanied by a fee of Rs. 10, and, provided the application is accepted by the Customs officer, a formal import licence will be subsequently issued by the Director-General of Posts and Telegraphs without further action by the passenger. The Customs duty assessed by the Customs officer is payable in addition to the import licence fee.

Iron and Steel Institute.

The autumn meeting of the Iron and Steel Institute is to be held at Glasgow this year on September 20th to 22nd, the sessions taking place at the Royal Technical College. Included in the papers which are to be presented and discussed are:—"High-frequency Induction Melting," by D. F. Campbell, and "Magnetic and other changes concerned in the Temper-brittleness of Nickel-chromium Steels," by H. A. Dickie.

Overhead Lines Club.

Several applications for membership of the "Overhead Lines Club" suggested by Mr. R. Borlase Matthews (ELECTRICAL REVIEW, August 19th, p. 326), have been received from engineers experienced in overhead-line construction. Whether the club takes shape or not will depend on the interest shown in the proposal and the amount of support that it receives; will those, therefore, who welcome its formation please communi-

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The staff of the Harrogate Corporation Electricity Department has presented Mr. GEORGE WILKINSON with a lamp standard on his retirement from the position of borough electrical engineer. Mr. Wilkinson has been in the service of the Corporation for 33 years. The presentation was made by Mr. N. McLean.

Mr. JAMES KERR-BOCK, formerly managing director of the Vickers Boiler Co., Ltd., and joint director of the Spearing Boiler Co., and recently with Messrs. Clarke, Chapman and Co., Ltd., has joined John Thompson Water Tube Boilers, Ltd. Mr. Kerr-Bock was at one time borough electrical engineer at West Ham, but has specialised in boiler engineering during the past few years.

On September 9th Mr. R. S. DOBBIE, for many years with Messrs. Rendel, Palmer & Tritton, is leaving to join his sons in New Zealand for the benefit of his health. Mr. Dobbie is a Batti-Wallah.

We are glad to learn by mail just to hand that Mr. J. ROBERTS, borough electrical engineer, Durban, was back at his post early in August greatly improved in health.

The Birkenhead Electricity Committee, at its meeting last week, decided to recommend the Council to confirm the appointment of Mr. FRANCIS EDWARD SPENCER, who since the retirement of Mr. G. P. Shallcross has been carrying out the duties of borough electrical engineer. Mr. F. W. BRECKNELL, who has been Mr. Spencer's deputy during the past year, is recommended for the position of assistant electrical engineer.

On August 20th Mr. EDMUND TOWELL, chief electrician at the Silverwood Colliery, Thrybergh, was married to Miss IVY SENIOR.

The marriage took place at Wollaston, Stourbridge, on August 23rd of Mr. HARRY L. NURSE, electrical engineer, and Miss MARY E. GUEST.

Obituary.—MR. T. BARKER.—The death occurred on August 14th, at the age of 61 years, of Mr. Thomas Barker, who had been works electrician to Messrs. Steel, Peech & Tozer, Ltd., of Rotherham, since 1899.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Heybrook Welding and Engineering Co., Ltd.—Private company. Registered August 24th. Capital, £2,500 in £1 shares. Objects: To acquire the business carried on at Entwistle Road, Heybrook, near Rochdale, as the Heybrook Welding Company, to adopt an agreement with L. Cavaghan and J. Fawcitt, and to carry on the business of general and marine engineers, boilermakers, aero engineers, founders, motor-car builders, electrical engineers, &c. The first directors are:—L. Cavaghan, 142, Heywood Road, Castleton, Rochdale; and J. R. Mellor, 129, Bolton Road, Marland, Rochdale, mechanical engineers. Solicitors: Brierley & Hudson, 32, Lord Street, Rochdale.

Multi Wiring and Instrument Co., Ltd.—Private company. Registered August 23rd. Capital, £1,500 in £1 shares. Objects: To carry on the business of mechanical engineers, contractors and merchants, manufacturers, licensors and licensees of machinery and wireless apparatus of all kinds, suppliers of light, heat, sound and power, &c. The permanent directors are:—E. S. Rogers, 50, Beda Street, Canton, Cardiff, and W. H. Franklin, 22, Fairfield Avenue, Cardiff, engineers; and H. C. Crofts, "Buenos Aires," Wellwyn Road, Whitchurch, Cardiff, factor and agent. Solicitor: D. J. Davies, 67, Queen Street, Cardiff. Registered office: 3, Paradise Place, Cardiff.

Garter Electrical Manufacturing Co., Ltd.—Private company. Registered August 25th. Capital, £200 in £1 shares. Objects: To carry on the business of manufacturers of scientific instruments for the deaf, manufacturers and producers of wireless telegraphy instruments and accessories, &c. The permanent directors are:—P. Gardam (chairman), "Rosefield," Kingston Road, Staines; J. L. Rutter (managing director), "Alfreda," Chertsey Lane, Staines. Secretary: J. L. Rutter. Solicitors: Phillips, Son & Rollinson, 147, Cannon Street, E.C. Registered office: Church Street, Staines, Middlesex.

A. Berkeley, Ltd.—Private company. Registered August 22nd. Capital, £10,000 in £1 shares. Objects: To adopt an agreement with Alice M. Berkeley, W. W. Randall, and E. Hibbard (exors. of the late A. Berkeley) for the purchase of the business of electrical engineers and factors now carried on by them at 111, Granville Street, Birmingham. The first directors are:—T. Horrocks, address not stated; F. Horrocks, 26, Oxford Road, Acocks Green, Birmingham; A. W. Gamble, 49, Hickman Road, Sparkbrook, Birmingham. Solicitor: F. E. Pill, 6, Cherry Street, Birmingham. Registered office: 111, Granville Street, Birmingham.

Tube Products, Ltd. — Private company. Registered August 22nd. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and factors of and dealers in metal tubes, and conduit tubes, and other fittings for electric wiring, metal rollers, wire drawers, steel makers, electrical, mechanical, hydraulic and general engineers, electricians, &c. The subscribers (each with one share) are:—J. H. Rice, 81, Oxford Street, Moseley, Birmingham; and H. C. Chambers, Kerri, Blakesley Road, Yardley, Birmingham, managing clerks. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

R. Brightwell, Ltd. — Private company. Registered August 25th. Capital, £7,000 in £1 shares. Objects: To acquire the business of an electrical and gas heating and lighting engineer carried on by J. R. Brightwell at 107, Queen's Road, Bayswater, W., as "R. Brightwell," and to carry on the business of aeronautical, motor and radio engineers, &c. The first directors are:—J. R. Brightwell, 56, Sutton Court Road, Chiswick, electrical engineer (permanent); M. R. Meetens, 1a, Clifton Park Avenue, Raynes Park, S.W.20, electrical engineer. Registered office: 107, Queen's Road, Bayswater, W.2.

Economic Electric Co. (Liverpool), Ltd.—Private company. Registered August 20th. Capital, £10,000 in £1 shares. Objects: To acquire the business of electrical engineers carried on by T. E. Jones and H. Jones at 127a, Oxton Road, Birkenhead, and at King Street, Mold, as the "Economic Electric Company." The permanent directors are:—T. E. Jones, 11, Lorne Road, Birkenhead; H. Jones, Lanercost, Lever Causeway, Higher Bebington. Solicitors: Lamb & Ashworth, 58, Hamilton Square, Birkenhead.

Macos Battery Manufacturing Co., Ltd.—Private company. Registered August 22nd. Capital, £100 in £1 shares. Objects: To carry on the business of electrical engineers, manufacturers, concessionaires, agents and dealers in apparatus and accessories connected with wireless telegraphy, &c. The permanent directors are:—Mrs. Alice Foster and V. Foster, both of 1, Clement's Road, East Ham, E.6. Registered office: 1, Clement's Road, E.6.

Standard Platinum Contact, Ltd.—Private company. Registered August 22nd. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in magnetos, motor engine valves and various parts thereof, &c. The life directors are:—C. E. Taroni, senr., engineer, and Mrs. E. A. Taroni, 121, Holden Road, Finchley, N.12; Mrs. C. Beard, 11, Gerda Road, New Eltham, S.E.9. Solicitors: H. E. & W. Bury, 47, Lincoln's Inn Fields, W.C.2. Registered office: 121 and 123, Shaftesbury Avenue, W. 1.

Official Returns of Electrical Companies.

Midland Valves, Ltd.—W. E. Withnall, of 19, Temple Street, Birmingham, was appointed receiver and manager on August 10th, 1927, under powers contained in debentures dated May 1st, 1925.

Pinnacle Switchgear, Ltd.—J. G. Farquhar, of Surrey House, Balfour Road, Weybridge, was appointed receiver and manager on August 15th, under powers contained in debenture dated February 28th, 1927.

Erith Electrical Co. (Barber & White), Ltd.—Debenture dated August 11th, 1927, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. B. Phillips, 77, The Brent, Dartford.

Mexican Hydro-Electric Development Syndicate, Ltd.—Particulars filed of £6,000 debentures and premium of 100 per cent. on redemption authorised July 18th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £3,250.

Hungerford and District Electricity Supply Co., Ltd.—Debenture dated August 17th, 1927, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. A. G. Mason, 82, Albert Hall Mansions, S.W.7.

Wm. Pool, Ltd.—Particulars filed of £500 debentures authorised July 10th, but executed on August 6th, 1927, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £300.

Park Radio & Engineering Co., Ltd.—Particulars filed of £500 debentures authorised August 10th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Express Magneto (Repairs) and Electrical Co., Ltd.—Mortgage on land with buildings thereon in Goldcroft, Yeovil, dated August 3rd, 1927, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £400.

Electric Welders (Leeds), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed June 11th, 1927). 1,000 shares taken up. £1,000 considered as paid. Mortgages and charges £400.

R. W. E. Braham & Co., Ltd.—Capital, £600 in £1 shares. Return dated December 31st, 1926 (filed June 23rd, 1927). All shares taken up. £600 paid. Mortgages and charges nil.

British Hanovia Quartz Lamp Co., Ltd.—Capital, £25,000 in £1 shares. Return dated April 12th, 1927. All shares taken up. £20,500 paid. £4,500 considered as paid. Mortgages and charges nil.

H. P. Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 29th, 1926 (filed June 7th, 1927). 654 shares taken up. £654 paid. Mortgages and charges nil.

Sherborne Electric Supply Co., Ltd.—Capital, £15,000 in £1 shares. Return dated April 7th, 1927. 12,031 shares taken up. £12,031 paid. Mortgages and charges nil.

Elkay Electrical Manufacturing Co., Ltd.—Capital, £1,000 in £1 shares. Return dated June 30th, 1927. All shares taken up. £1,000 paid. Mortgages and charges nil.

Tees Power Station Co., Ltd.—Satisfaction to the extent of £20,000 on various dates between April 1st and August 10th, 1927, of trust deed dated May 7th, 1918, securing £600,000.

Cary, Hallewell & Co., Ltd.—Capital, £2,500 in £1 shares. Return dated April 8th, 1927. All shares taken up. £2,500 paid. Mortgages and charges, £700.

N.E.S. (Bradford), Ltd.—Capital, £1,500 in £1 shares. Return dated April 1st, 1927. 1,100 shares taken up. £900 paid. £200 considered as paid. Mortgages and charges nil.

Arrota Electrical and Motor Accessories Co., Ltd.—S. P. Child, of 36 and 37, Queen Street, E.C.4, ceased to act as receiver or manager on July 12th, 1927.

C. & J. Arrigoni, Ltd.—H. F. Crowley, of 65-66, Chancery Lane, W.C., ceased to act as receiver or manager on May 31st, 1927. (Notice filed August 16th.)

Atlas Wireless Co., Ltd.—G. Dickinson, of 82, Victoria Street, S.W.1, ceased to act as receiver or manager on August 12th, 1927.

City Notes.

Underground Electric Railways Co. of London, Ltd.

The adjourned meeting of the 6 per cent. income bond holders was held on August 26th to consider a scheme of arrangement whereby the interest on the bonds will be paid subject to tax, instead of tax-free, the holders having the right to convert their bonds into ordinary shares. Lord Ashfield (chairman) presided, and in presenting the scheme, said that although the companies in which they held an interest could not declare large dividends, being public utilities, it was not necessary that the profits of those companies should be extravagant in order that the parent company should receive an income which would allow of a very satisfactory dividend on its ordinary capital. The shareholders of the company had not received a penny upon their investment for nearly 25 years. If the scheme was not accepted the directors would have to find some other method of reducing the rate of interest payable by the company, and that would almost certainly involve the retirement of the bonds at par without any option of conversion. He considered that the improvement in the market price of the bonds showed that the scheme was not unfair to the holders.

It was suggested by certain bondholders that the price of conversion should be reduced from 21s. to 20s. per ordinary share, and that the interest on the bonds should be cumulative. The chairman said that he could not fairly ask the shareholders to agree to further concessions with regard to the conversion price, and that the company had provided a substantial sum to ensure the maintenance of the dividend. Upon a show of hands the resolutions were lost, but a subsequent poll gave the following results: For the resolutions, £850,260; against, £199,210. The chairman therefore declared the resolutions carried by the requisite majority.

Wellman Smith Owen Engineering Corporation, Ltd.

The annual meeting was held last week. Mr. F. N. Pickett (chairman), who presided, said that the holding up of the delivery of raw materials by the coal stoppage had seriously affected the company, causing a loss to be incurred. The Wellman-Seaver-Morgan Co. had had a better year, and was now re-established on a profit-earning basis. The work secured for the corporation by its subsidiary, the Wellman-Seaver Rolling Mill Co., Ltd., had proved of great value. It was difficult to prophesy regarding the company's future; it depended upon the state of the iron and steel industries, their principal customers. There were, however, signs of more prosperous conditions.

Columbia Gas and Electric Corporation.

The gross earnings for the year ended June 30th last amounted to $96,058,586, and the net operating earnings to $30,116,836, to which was added other income, making $32,772,870. After meeting rentals, interest, &c., the net income was $23,616,950.

Calgary Power Co.

The gross earnings for the past year amounted to $450,961, and the net profit to $125,426; the latter sum has been transferred to surplus account. During the year $230,614 was expended, mainly on extensions in the province of Alberta.

Swiss Company.

Brown, Boveri & Co., Baden, report a net profit of £187,368 for the last financial year. It is proposed to place £20,000 to reserve, and £10,000 to the workers' aid fund, and to pay a dividend of 8 per cent.

Shawinigan Water and Power Co.

A dividend of 50 cents per share has been declared on the common shares in respect of the quarter ending September 30th.

The company has called a special meeting of shareholders for the purpose of securing authorisation to issue $200,000,000 of bonds necessitated by the contemplated expansions of the company's operations.—*Reuter's Trade Service* (Ottawa).

St. Maurice Power Co.

The St. Maurice Power Co. (Canada) has declared an initial dividend of $1 per share on the common shares for the quarter ending September 30th.

Clyde Valley Electrical Power Co.

An interim dividend of 3 per cent. actual (as in 1926) has been declared on the ordinary shares.

Stocks and Shares.

MONDAY EVENING.

As the end of the holiday season comes within sight, so does the volume of business increase in the Stock Exchange in the industrial shares which, throughout the whole of August, have been so popular. The sections that are concerned with shares in the electrical equipment and cable construction companies have come prominently to the fore. We were mentioning last week, as a subject for interesting discussion, the possibility of an amalgamation or agreement of interests between the companies in the cable manufacturing group, suggesting that such a thing might become practical politics in the future. It would appear as though intelligent anticipation intended to run away with this idea, and to accumulate shares in such companies, well in advance of any official announcement that might be made. In the circumstances, it is a little surprising that one or other of the companies has not disclaimed even the likelihood of such a thing happening, because, unless there is something going on behind the scenes of which the ordinary public are unaware, prices in the market are being run up to levels which require a good deal of excuse for their justification.

That Blessed Word "Amalgamation."

To take a single case, Henleys stand at £5 1s. 3d. per share, and the company's last dividend being 25 per cent., this means a yield of less than 5 per cent. on the money. Several of the others pay equally modestly on the money, as may be seen by reference to our price lists. The reason for the optimism which prevails in regard to a possible amalgamation, to take place at some time or other, resides in the conviction that most of the good companies possess hidden reserves which would be brought to light if assets were lumped together for the purpose of a general agreement. In the process, continues this contention, it would be found that the sum of assets in the soundly-managed concerns is likely to exceed substantially the valuation at present placed upon them. It is not only in the shares of cable construction companies, but also in those of the electrical equipment undertakings, that the same persistency of demand prevails. English Electric debentures suddenly shot up five or six points, and the shares strengthened noticeably. General Electrics, Siemens, Brush, Metropolitan Vickers, Enfield ordinary (at 76s. 3d.), and others in this department, are all better. However far it may be that popular fancy is going ahead of immediate prospects, there is no doubt as to the substantial character of the buying. Few shares have been overlooked in the attention of the present purchasers, but Telegraph Constructions are unchanged, no doubt owing to the fact of the price being what the Stock Exchange calls heavy.

Automatic Telephones had a swift rise of 2s. 6d. to 48s. 9d. International Automatic Telephones, which have been hanging fire, underwent a violent advance to 44s. 6d. for the ordinary and 43s. for the "B" shares. Telephone Manufacturing rose to 7s. 9d.

Underground Scheme Effect.

The Underground Electric Railways of London scheme was passed, but not without opposition, at last Friday's meeting. Interest on the company's 6 per cent. income bonds will become subject to tax, instead of being paid, as at present, tax free. The bonds will carry, however, an option for conversion into the company's shares, for three years, at 21s. per share. The price of the existing shares is 19s. Lord Ashfield, at the meeting, stated that an additional 1 per cent. dividend on the 15 million pounds ordinary shares held by the Underground Electric Railway in various London transport companies would represent an extra 3 per cent. on the 5 million pounds ordinary capital on the former undertaking. A feeling of disappointment is expressed at the refusal of the Underground Electric board to reduce to 20s. the price at which the bonds will become exchangeable into shares. No movement occurred in the prices. Metropolitans forge ahead. The abrupt fall caused in July by the announcement of a reduced dividend has now been more than recovered. Already the talk runs of a final dividend for 1927 which shall make the full year's rate equal to that of 1926. Holders of Districts have been selling their stock and putting the money into "Mets.," with the result that Districts are lower at 62¼ and Metropolitans 1¼ up, at 58. Central London assented ordinary stock is ex dividend. The Southern Railway contemplates making an early start upon the long-projected work of a new line linking Sutton with Wimbledon.

London tramway shares are not quite so exuberant as they were last week. London & Suburban Traction, in which there was a fair amount of mild speculation, reacted to half-a-guinea. On the other hand, the company's first debenture rose 5 points to 70, and London United Tramways preference are better at 9s.

The Record Breakers.

Brazilian Tractions continue their triumphal progress. This week's rise of 7½ points, following one of 5 recorded in our last letter, has lifted the shares to 185½. Shares are now becoming scarce, and the amount of daily business is limited. The 6 per cent. cumulative preference have risen to 154½. Other members of the group exhibit strength, but their attractions have been overshadowed by the excitement surrounding artificial silk, electrical and cable equipment, and other industrials that now stand high in popular favour. Mexican Utilities have regained some of their lost ground. The Light and Power Company's preferred shares are up 5, to 75½. Mexican Electric Light 5 per cent. bonds have strengthened to 66½.

Electricity Supply.

The share list of Home electricity companies has few variations amongst the London descriptions. London ordinary and preference are higher, both being quoted ex dividend. Notting Hill preference hold their recent gains. City Lights are 9d. better at 29s. 6d. South Metropolitan preference recovered the dividend deduction. At 27s. 6d. Urbans maintain their last week's advance of half-a-crown, while Edmundson's also stand 2s. 6d. higher at 37s. 6d. The rises are due to talk of a possible bonus distribution, in each case. Provincial shares are very steady. Newcastle-on-Tyne ordinary went up 6d., and others of similar class are in request. The demand for such shares as these is based upon the impression that wider scope for expansion is to be found in their areas than in those of the purely London undertakings. The Central Electricity Board is expected to make an announcement this month regarding its new scheme for London, the Home Counties and the South-East of England.

Investment is not unwilling to accept the slender yields offered at the present time—Midland Counties, *e.g.*, return 5½ per cent.; Yorkshires 5½ per cent., Clyde Valley 5 guineas, and so on—the purchaser looking to the future for better income. Still more of an attraction is the hope that, as these companies develop and require more capital for expansion of their activities, new issues of shares will be made at prices low enough to ensure a bonus to proprietors. People are a good deal keener nowadays on bonuses, and the usual price-appreciations thereby frequently involved, than they are upon dividends which carry liability for income-tax. Mention of the Clyde Valley is a reminder that the company has declared its usual 3 per cent. interim dividend on the ordinary shares. This infers the likelihood of a repetition of another 5 per cent., making 8 per cent. for the year, six months hence.

Cable and Wireless.

The cable group is so quiet as to call for no comment. Speculation savours no salt, in this section, such as gives the tang to dealing in the manufacturing companies' shares. But telephones are active and strong. The rises in Automatics and International Automatics have already been noted. Foreign telephones are also hard, though United River Plates remain at 10⅞. Anglo-Portuguese and Bogota Telephones are wanted at 20s. 9d. and 33s. respectively. Venezuela Telephones keep around 25s.

Inquiry edges round towards Marconi and other wireless shares. The price of the former is better than it looks from the official quotation, and, with industrials in such favour, Marconis may easily go above the round 20s. at which there are (for the moment) a good many selling limits. Marconi Marines have repeated last week's gain of 1/16 and the buying is based on a confident expectation that the dividend will be raised to 10 per cent. The rate last paid, 8¾ per cent., was 1¼ per cent. higher than that for the preceding twelvemonth. Canadian Marconis have improved to 6s. 7½d., attracting a good deal of public business.

Forcing the Pace.

Iron, steel and engineering shares participate in the general cheerfulness. Armstrongs are better, upon the excellent contracts which the company is now securing. Vickers failed to hold the full extent of their recent rise, reverting to 11s. 7½d., after 12s. Babcocks are unaltered at 52s. 6d. The question is constantly debated in the Stock Exchange as to whether the advance in some of the industrial groups is not being carried rather far. A few people have taken advantage of the boomlet, and have sold shares. English Electrics touched 14s. before reacting to 12s. 6d., and it must be admitted that the latter price looks tolerably high, as things are at present. The eagerness of the buying movement that occurred in various other shares of this group is thought, by cautious counsellors, to have raised prices to pedestals sufficiently high. The public "urge" for industrials is the result of there being no other market in the Stock Exchange that presents any particular attraction for speculative dealing. Rubber shares are dull on account of a dwindling in the price of the raw produce. Mining shares draw less attention than those in the companies which supply the mines with plant, electrical power, &c. Victoria Falls ordinary and preference keep their strength.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Aug. 29 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	37/-	—	4 18 8
Brompton Ordinary	£1	10	8⅝	24/6xd	—	5 14 3
Charing Cross Ordinary	£1	15	8½	35/6	—	5 9 10
do. do. 4½ Pref.	£1	4½	4½	17/6	—	5 2 10
Chelsea	£1	12	8¾	25/-	—	5 12 0
City of London	£1	15	10	29/6	+9d.	4 15 0
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Clyde Valley	£1	8	8	30/6	—	5 5 0
County of London	£1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	£1	8	10	37/6	+2/6	5 6 8
do. 7% Pref.	£1	6	7	24/6	—	5 14 3
Elec. Supply Corporation	£1	10	10	32/-	—	6 5 0
Kensington Ordinary	£1	15	8	25/6	—	5 9 10
Lancs. Light and Power	£1	7½	7½	26/-	—	5 15 8
London Electric	£1	10	8½	24/6xd	+1/-	5 14 3
do. do. 6% Pref.	£5	6	6	5½xd	+⅛	5 9 1
Metropolitan	£1	11	8	29/6	—	4 14 11
do. 4½% Pref.	£1	4½	4½	17/-	—	5 8 6
Midland Counties	£1	5½	6	21/6	—	5 11 7
Newcastle-on-Tyne Ordinary	£1	7	5	22/6	+6d.	4 9 0
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	£10	6	6	10½	—	5 14 3
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	8	25/6	—	5 9 10
South London	£1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	£1	7	7	1¼xd	+6d.	6 3 0
Urban Ordinary	£1	7	7	27/6	—	5 1 10
do. 6% Pref.	£1	6	6	1⅛	—	5 13 0
Westminster Ordinary	£1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	21/-	—	7 2 10
Yorkshire Elec.	£1	8	8	30/-	—	5 6 8
Home Rails.						
Central London Ord. Assented	Stock	4		70xd	—	5 14 4
Metropolitan	,,	5	8	58	+1½	5 3 5
do. District	,,	3½	3½	69½	—½	5 12 0
Underground Electric	£1	Nil	1½	19/-	—	1 11 5
do. do. Income	Bonds	6	6	103	—	*5 16 6
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	25	—	6 0
Automatic Telephone	£1	8	10	48'9	+2/6	4 2 0
Chili Telephone	£5	5	6	7⅞	—	3 1 3
Eastern Extension	£10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	173½	—	*5 12 1
Globe Tel. and T. Ord.	£10	10	10	18½	—	*5 7 5
do. do. Pref.	£10	6	6	11	—	5 8 1
Great Northern Tel.	£10	20	20	30½	—	6 11 0
Indo-European	£5	8½	10	44½	—	*5 7 6
Marconi	£1	Nil	Nil	18/9	—	.. ..
Marconi-Marine	£1	7½	8⅞	28/9	+1/3	6 1 9
Oriental Telephone Ord.	£1	12	12	52/6	—	*4 9 4
United R. Plate Tel.	£5	8	8	10⅜	—	*3 17 1
Western Telegraph	£10	10	10	17⅜	—	*5 13 6
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	8 7/16	—	8 0 0
do. do. 2nd Pref.	£5	6	6	8 7/16	—	8 14 6
do. do. 5% Deb.	Stock	5	5	72½	—	6 17 11
British Electric Traction Def.	£1 Ord.	8	8	500	—	.. ..
do. do. 8% Pref.	Ord.	6	8	119½	—1	6 14 0
Brazil Traction	£100	5	6	185½	+7½	3 4 5
Brit. Columbia Elec. Ry. Pcs.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	£1	6¼	6¼	130½	+1	4 15 8
do. do. Deferred	,,	8	8	161	—	*4 19 5
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	10/6	—6d.	Nil
London United Tram. Deb.	Stock	4	4	53½	—	7 19 5
Mexico Trams, 5% Bonds	£—	5	5	74	—	6 15 2
Mexican Light Common	£100	Nil	Nil	40½	—	Nil
do. Pref.	£100	Nil	Nil	75½	+5	Nil
do. 1st Bonds	£—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	£1	5	—	8/9	—	.. ..
Manufacturing Companies.						
Babcock & Wilcox	£1	13	13	52/6	—	4 19 1
British Aluminium Ord.	£1	12½	10	48/9	—	4 2 0
British Elec. Transformer Pref.	£1	Nil	7	18/3	—	7 18 6
British Insulated Ord.	£1	15	15	3½	+5/-	3 18 9
Brush Ord.	£1	10	10	28/9	+2/6	6 19 2
Callenders	£1	15	15	3¾	+¼	4 0 0
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Pref.	£1	Nil	Nil	16/-	—	.. ..
Edison-Swan	£1	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	88	—	5 13 8
Electric Construction	£1	10	7½	26/3	—	5 14 3
Enfield Cable Pref.	£1	7½	7½	25/-	—	6 0 0
English Electric	£1	Nil	Nil	12/6	+3/9	.. ..
do. do. Pref.	£1	8	—	15/-	—	.. ..
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 10 6
do. Ord.	£1	7½	7½	31/9	+1/3	4 14 6
Henley	£1	20	25	5⅛	+6/3	4 18 3
do. 4½% Pref.	£5	4½	4½	4½xd	+2/-	5 6 0
India-Rubber	£1	5	5	19/6	+9d.	*5 2 7
Johnson & Phillips	£1	17½	12½	48/9	—	5 2 8
Met.-Vickers Ord.	£1	8	8	28/9	+2/-	5 11 4
do. Pref.	£2	8	8	2⅜	—	6 14 8
Siemens Ord.	£1	7	7½	30/-	+3/6	5 0 0
Telegraph Construction	£3	10	10	27½	—	*4 7 4

* Dividends paid free of Income Tax.

Multi-Range A.C. Instruments.

A *résumé* of the various types of instruments suitable for a.c. measurement at power frequencies, and their applicability to various purposes.

By E. H. W. BANNER, M.Sc., A.M.I.E.E., A.Inst.P.

(*Concluded from page* 341.)

A method which seems quite obvious has recently been marketed by one firm [21]; this consists of an ordinary moving-iron movement, but without a bobbin. A number of detachable bobbins wound with differing numbers of turns are supplied, and are placed over the movement as required.

The ampere-turns of each coil are the same, but as the actual disposition of the windings is different for the different coils, it is not found possible to use a common scale with various scale factors. Accordingly a different scale is used for each range of current. By this means any number of ranges bearing any ratio to each other may be employed, and in this particular case only it is unnecessary so to choose the ratios that a common multiple of 2, 5 or 10 is obtained, on account of the independent scales. A less common arrangement which is usually only suitable for relatively high ranges, say, 30-300 A, is to incorporate the secondary winding of a current transformer in the instrument, this being permanently connected to the instrument winding. The core of the transformer has a projecting part at the back or foot of the case, through which is threaded a conductor in the main circuit. Assuming a particular movement to require 300 ampere-turns for full scale deflection, the main conductor passing through the ring will indicate full scale deflection with 300 A. The case is very similar to that of the instrument containing a transformer secondary, as detailed earlier.

A new type of ammeter, which is essentially a multi-range one, is used in an ammeter recently marketed by Messrs. Crompton [22]. This consists of a laminated-iron ring with an air gap. In this air gap is a pivoted moving-iron which is constrained by a spring to a position practically at right angles to the flux lines through the iron and air gap. Insertion of a conductor through the iron ring, part of which projects at the back or base of the instrument, induces a flux in the iron proportional to the current—assumed alternating. This flux operates on the movement, tending to rotate it across the pole-pieces. The scale shape is variable, and may be open or contracted at any particular part. Any number of turns may be passed through the ring, but the lowest practicable range is about 10 A, as more than about ten turns becomes very unwieldy. This instrument is unique for a multi-range ammeter in having only one transfer of energy, *i.e.*, from the electric to the magnetic, instead of from the electric to the magnetic in a transformer, then to the electric, in the bobbin, and finally again to the magnetic.

A method of winding a moving-iron instrument was devised by the author recently, but was afterwards found to have been anticipated by Dr. C. V. Drysdale, who described it in his lecture at the Physical Society Exhibition, January 5th, 1927. This method does not appear to be incorporated in any commercial instruments at the present time. It consists of winding the coil with a number of strands of wire, each wire having the same resistance, inductance, and magnetic effect on the core. The windings may then be connected in parallel, series-parallel or series, depending on the number of windings. The windings should be of an even number, and the more windings, the greater the number of ranges, but the ratio of highest to lowest current range is determined by the number of windings. If there are n windings, the ratio of the ranges will be n, so that if 8 windings are incorporated, and the lowest range is 1 A, the other ranges will be 2, 4 and 8 amperes, each range being double the previous one. The great advantage is that all the windings are in use on any range, so that there is no space wasted. The current density in each wire at full scale deflection is constant, and the watts for full scale are constant for each range. Care is needed to distribute the windings so that the magnetic effect is the same for each conductor. If this is not done, the multiplying factor will not be exactly 2, 4, and so on, on account of some windings tending to produce a greater torque than others. Dr. Drysdale's method, which is very ingenious, was described in his lecture.

The change of range can be accomplished most simply, from the manufacturing aspect, by having terminals and links, or plugs and sockets. A better way in use, however, is to have a commutator fitted so that rotation of its axis performs the change of connections. This commutator needs to be very well made, so that contact resistances are low and constant. The moving-iron voltmeter is almost as amenable to multi-range application as the ammeter, and in some respects is simpler. In a voltmeter, except one of extremely low range, the resistance is great compared with the inductance, so that the time constant is low. A plain non-inductive resistance is then all that is required for increasing the working range to any amount, and owing to being non-inductive, it is simpler to produce and to adjust, unlike the shunted ammeter.

Similarly, a single coil with tappings may be used if the instrument is of the type that has all its wire wound on the working bobbin, and made of resistance wire. This method is not so good as that of having a copper winding and a high series resistance, which is now the usual practice with most makers. The expedient of having a number of separate windings, as for the ammeter, is of no particular use, as the current is so small that grading the wire is unnecessary, and it is better to have one winding with tappings, if this method is adopted. The employment of potential transformers is a very common means of providing a number of ranges, and, as with the current transformer method, either a number of transformers, or one transformer with variable ratio may be used.

Potential transformers are rated by B.E.S.A. at 50 volt-amperes. The employment of separate detachable coils is applicable to voltmeters as well as to ammeters, but it does not appear to be adopted to any great extent. It is impracticable to construct a multi-range instrument with a self-contained transformer having a secondary winding connected to the coil, with the primary formed by the test circuit, owing to the large number of turns which would be required. The series-parallel grouping is nearly as useful as it is to ammeters, but care must be taken with the insulation, as adjacent conductors may have to withstand as much as half the applied voltage. This also is only suitable if all the winding is on the coil, instead of the bulk of it being a swamp. There is at least one moving-iron volt-ammeter on the market [23]. This consists of a voltmeter winding with a d.p. change-over switch to connect the winding either to terminals for voltage measurement or to the secondary of a transformer, which has its primary terminals connected in series with the mains for current measurement.

This is capable of various multi-range devices, but it then becomes complicated in construction and use. Probably the best method is by the use of inductive shunts and non-inductive series resistances.

Dynamometer Instruments.

Most of the devices described for the moving-iron ammeter are directly applicable to the dynamometer instrument.

The series-parallel arrangement is the commonest, but usually with two ranges only. It is not possible to have detachable coils as in the case of the moving-iron instrument, but inductive shunts, transformers, &c., may be employed as previously described. Voltmeters may be treated as for moving-iron instruments, with the reservations applying to the dynamometer ammeter, and the fact that the series-parallel connection for voltmeter windings is uncommon in practice.

Induction Instruments.

Ammeters of this type are most simply constructed as multi-range instruments by the use of transformers, exactly as for moving-iron instruments. Inductive shunts are also possible, and for a two or three range instrument this forms the simplest and cheapest method. For fairly high ranges a current transformer without a primary winding may be incorporated, the conductor being threaded through the projecting loop of the core any number of times. This also is exactly the same as for the moving-iron ammeter. For voltmeters, the devices detailed as applicable to dynamometer voltmeters are suitable. Potential transformers and series non-inductive resistances form the most general and reliable means of obtaining a number of ranges.

Wattmeters.

Although wattmeters have not been detailed before, it is obvious that the pressure coil of a wattmeter may be treated as a voltmeter winding, and the current winding as for an ammeter. This may not hold in all cases, but in general it is true. A point to be observed is in the possible errors due to a phase angle between main current or voltage, and that applied to the indicator. Phase-angle error in ammeters is of no consequence, but in wattmeters a large error is disastrous. The best transformers, conforming to B.E.S.A. specifications, are free from appreciable errors for all commercial testing. For precision measurements, or measurements at low power factors, the possible errors must be known.

Finally, reference must be made to the valuable books of Drysdale and Jolley, from which some of the figures quoted were obtained. Part II of this book deals in detail with some of the various multi-range methods.

Thanks also are due to the various firms enumerated for information on their respective instruments.

There has recently been an improved type of induction instrument marketed by Messrs. Nalder Bros. and Thompson, Ltd., who state that the consumption is now reduced to about 5 VA for ammeters and about 3 VA for voltmeters. Messrs. Everett, Edgcumbe & Co., Ltd., also have lately produced an improved induction instrument, and first-grade accuracy (B.E.S.A.) has now been attained in both cases.

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Dental Radiography.

A constructional description of the "Sunic" Mark II mobile X-Ray outfit manufactured by Messrs. Watson & Sons (Electro-Medical), Ltd., for use in the dentist's surgery.

WHILST appreciating the highly professional nature of dentistry, the fact that it is a commercial enterprise must not be lost sight of.

In this connection the installation of X-ray equipment in the surgery creates prestige and goodwill; it distinguishes its owner as being up-to-date in his ideas and methods, eliminates the delay involved in sending patients elsewhere to be radiographed by enabling examination to be completed at one sitting, and helps the dentist to render better service by giving him the means of confirming his diagnosis, checking manipulative operations, and disclosing concealed defects. The "Sunic" Mark II mobile outfit of Messrs. Watson & Sons (Electro-Medical), Ltd., occupies a floor space of 18 by 18 in. only, and it may be placed in any position relative to the patient's chair. It is claimed that its operation does not demand expert electrical knowledge, and the exercise of ordinary intelligence and reasonable care will avoid any danger; the equipment conforms to the recommendations of the X-ray and Radium Protection Committee.

The cabinet (fig. 1) is provided with castor wheels and an upright pillar supporting the adjustable arm which carries the X-ray tube. The wire which carries the high-pressure current is led through the top of the pillar to the tube by an insulated spreader which keeps it in a safe position well away from both patient and operator; all danger points are either enclosed or protected. On top of the cabinet are mounted the electrical controls, and at the side hangs an automatic time switch by which the actual exposure is made. The cabinet, in addition to the counterbalancing apparatus for the tube support, contains the step-up transformer which converts the low voltage received from the main to high voltage, the auto-transformer which provides the means of adjustment for variations in main-line voltage, and the auxiliary transformer which heats the Coolidge-tube filament; special wiring enables the auto- and the filament-heating transformers to be operated by one control. Grasping the knob at the side of the tube shield, one can move the tube up, down, sideways, backwards, and forwards, in any desired direction; further, by rotating the knob, one can tilt the tube at any desired angle. The tube arm slides freely on the upright pillar upwards and downwards, and the elbow joints on the tube arm give free movement backwards and forwards. A clamping screw locks the upright movement, if desired. Tilting movements are provided by a knuckle joint at the junction of the tube arm and tube carrier, and a further fine adjustment on the axis of the latter. The last movement is entirely new, and of the greatest importance as, when the tube is roughly placed, it allows of that precision of angling which is necessary for good radiography. When the tube arm is extended or closed, the high-pressure wire spreader goes with it, and slack wire is taken up automatically by a spring reel.

The radiator type of Coolidge tube employed rectifies its own current and requires no regulation. It has the fine focus essential for the successful radiography of bony structures and a constant output; it is constructed in such a way that the negative portion can be brought close to the face of the patient without danger. This tube operates on a current of 45,000

volts, r.m.s., and 10 milliamperes, and is enclosed in a lead-glass protective shield of high metallic content, so that only those rays employed in making the radiograph are allowed to reach the patient, and the operator is fully protected. This shield has been tested by the National Physical Laboratory and the protection it affords is equivalent to 1.5 mm. of metallic lead. A special safety cage and guard are fitted to the carrier (fig. 3) which protect the tube and radiator and prevent the possibility of either operator or patient coming into contact with that portion of the apparatus which carries the high-pressure current.

On the side of the cabinet (fig. 2) are the milliamperemeter immediately above the current-control knob and the voltmeter above the voltage control knob; between and below them is a pull-up switch which controls the filament-heating transformer, and immediately above this is a ruby warning lamp which is automatically lit from below when the main current is switched on. The controls are extremely simple and conveniently situated. The actual exposure is made by means of an automatic time switch attached to a length of "flex" leading from the side of the cabinet (see fig. 1) and held in the hand of the operator. The dial is marked in seconds, and to make an exposure of any required length it is only necessary to set the pointer by turning the milled head. When the knob is pressed the correct exposure will be given automatically and can be terminated instantly at any time by releasing the pressure. Exposures of any length can be given without using the timing mechanism, if desired; the switch has an exposure range of 0-12 seconds in quarter seconds.

Developing, fixing, and mounting the films, and viewing the finished radiographs, are made simple routine processes by the use of ready-compounded chemicals and convenient apparatus. Due regard has also been paid to the appearance of the outfit. The cabinet is made of polished mahogany, the tube arm and carrier harmonising with it, whilst all the other metal fittings are nickel-plated.

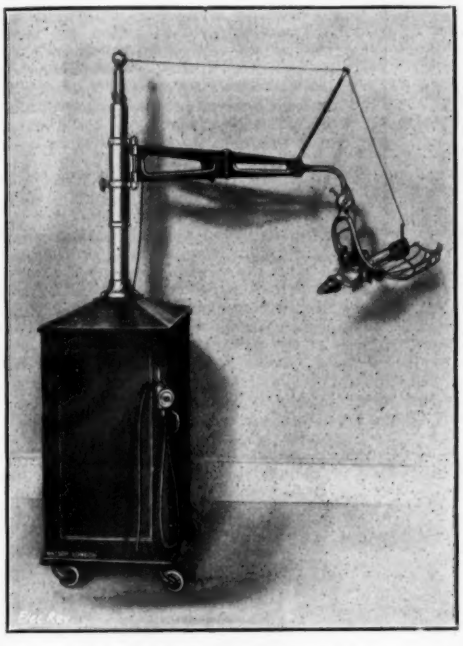


Fig. 1.—"Sunic" Dental X-ray Outfit.

Fig. 2.—Cabinet, showing Control Switches and Meters.

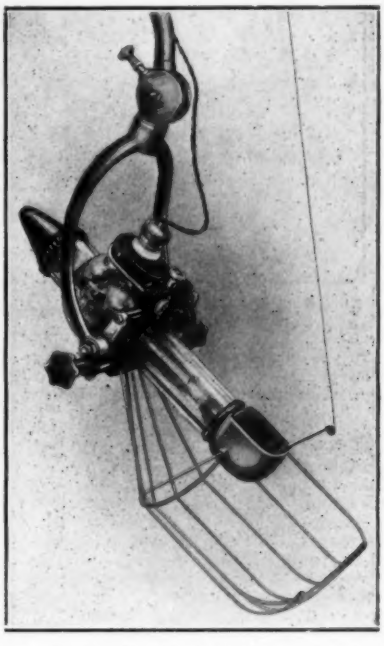


Fig. 3.—Coolidge Tube in Carrier and Guards.

Electric Fire-Alarm Systems.

Messrs. Standard Telephones & Cables, Ltd., and Automatic Telephone Manufacturing Co., Ltd., have each recently introduced a system of public fire-alarms which is electrically controlled, but mechanically operated, and works on the closed-circuit principle.

WITH the modern improvements and developments in fire-fighting appliances and the increased congestion of large industrial areas, it becomes more and more essential to provide quick and reliable facilities for notifying the responsible bodies of outbreaks of fire. The essential feature of a fire-alarm system should be a distinctive signal to the fire brigade definitely locating the position from which the call for assistance has been given. This, of course, can be done with quite simple electric-bell and indicator circuits, but in large towns it is found necessary to install apparatus that will meet stringent conditions and emergencies that would probably not be encountered in the ordinary way.

The Standard Telephones System.

The "Gamewell" fire-alarm system, as manufactured by Standard Telephones & Cables, Ltd., is essentially, it is claimed, a fool-proof system, and has been developed to meet as far as possible any emergency that may arise. It is claimed to be proof against broken or faulty lines, broken wires being automatically "patched" and the signals received as accurately and speedily as with the perfect line. The "patching" is accomplished by automatic earthing contacts arranged in each box, which, in conjunction with a special switch on the board at the fire station, enable a broken or faulty circuit to be worked on an earth return until such time as the series metallic circuit can be restored. Operation is normal with earthed lines, and simultaneous calls do not derange the apparatus. A permanent record of every call is given on a paper tape. The system also has the advantage of requiring only a single-line circuit, the call boxes being arranged in series up to a certain number, above which additional series circuits are used.

The apparatus is electrically controlled, but mechanically operated. The necessary mechanical power is supplied by powerful main springs which are periodically hand wound, the mechanism being released or controlled as required by means of an electro-magnetic device. The movements have been specially designed for conditions of intermittent use with long periods of idleness, and very little attention is required to maintain the equipment in a satisfactory working condition. Street alarm boxes are employed, and when one is operated the electrical circuit is automatically interrupted a certain number of times, according to the code number allotted to the box. The alarm is received in code form at the fire station on a register and on a gong. The gong twice gives the alarm and indicates the location of the call, whilst the register makes the permanent record on a paper tape of the code number of the box from which the alarm originated. A time stamp can be added to give automatically the time of the call; the full code stamped with the date and time is left exposed to view on the tape when the register stops. A view of one type of register with its take-up reel and time stamp is shown in fig. 1.

The street boxes, fig. 4, consist of weatherproof cast-iron cases which are usually mounted on posts erected at convenient places. A pull handle is provided under a glass cover on the front of the box, and this operates a mechanical movement inside the box which actuates the necessary contacts. The

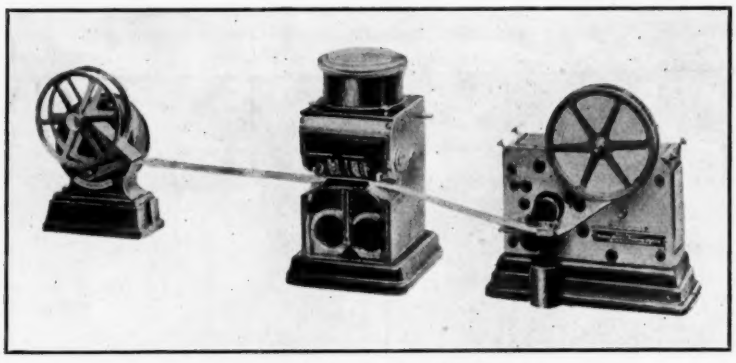
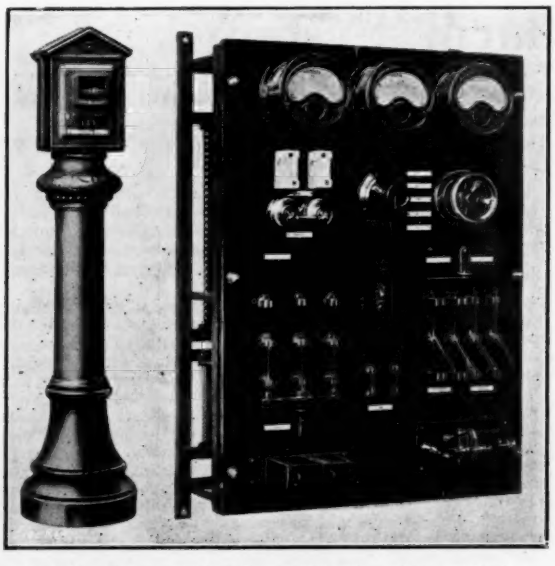


Fig. 1.—Registering and Timing Apparatus.

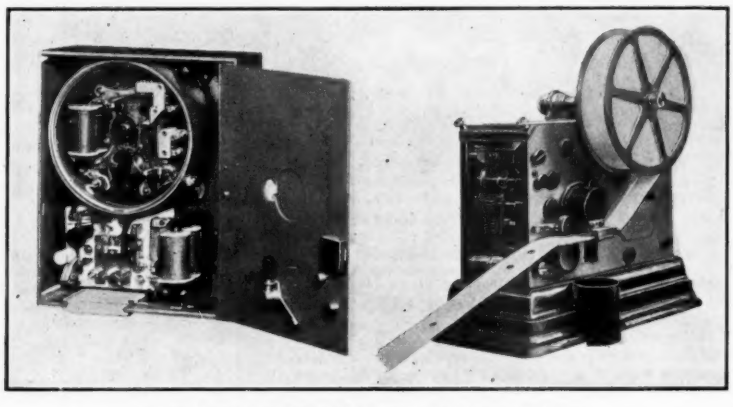
box also contains telegraphic apparatus and equipment for testing the movement without interfering with the system. Provision can also be made for telephonic communication with the fire station, if desired. The box is constructed with three cases. The outer case carries the pull-handle mechanism, the intermediate one contains the main terminals, protectors, and telephone jacks, while the third houses the electrically operated mechanical movement, fig. 2. This construction protects the movement from the effects of temperature changes. The adjustment of the movement is quite permanent and the method of mounting is claimed to render it immune from disturbance by the heaviest of street vibrations. The glass protecting the outer chamber is mounted in a frame, hinged at the bottom, so arranged to fall forward when the glass is fractured, thus effectively removing all broken and jagged glass and leaving the handle properly exposed for operation without danger of cutting the hand.

A useful modification of the "Gamewell" system consists of the "Auxiliarised" box for use outside large buildings where fire risk is a particularly serious matter. The "Auxiliarised" box forms part of the public fire-alarm system, and can be operated in the usual way by anyone in the street, but a pair of wires are taken from it to as many small "Auxiliary" pull boxes as are required in the building to be specially protected, say one on each floor. The "Auxiliary"



Figs. 4 and 5.—Street Alarm Box, and Charging and Control Panel.

boxes consist of small neat castings containing a simple "pull" protected by glass. When the glass is broken and the "pull" operated, the latter remains locked in the operated position and the effect is the same as operating the street box. Incidentally, the arrangements are such that the street box cannot be reset until the "Auxiliary" pull box has been properly restored. The alarm boxes and station apparatus are connected in a closed series circuit which is adjusted to carry a steady current of 1/10 A, and where the number of instruments employed is such that the battery voltage necessary to pass this current becomes excessive, then additional series circuits are used. In the case of lines rented from the British Post Office, the maximum voltage allowable on any one circuit is 70 V. The closed-circuit system has many advantages. It is more reliable to depend upon a circuit break than upon a circuit make, especially as the signalling contacts in the alarm boxes are idle during the greater part of their life; further, trouble from dirty contacts is entirely eliminated. Again, automatic supervision over the system is provided by the fact that a break in the circuit at any point is immediately brought to the notice of the fire staff by the operation of the gong and the register, and faulty calls due to external electrical disturbances are also eliminated. The use of a single loop connecting up a number of alarm boxes results in a low rental charge for the line, or in low constructional cost where the line has to be specially laid; it also minimises the likelihood of faults in the line wires and thereby keeps down the cost of maintenance.



Figs. 2 and 3.—Control Movement, and Alarm Register.

Apart from the question of voltage, there is a practical limit to the number of street boxes which it is advisable to install on one circuit. An extensive circuit becomes too cumbersome to handle with efficiency and maintain with the necessary speed. For this reason it is usual to provide a large area with a number of circuits or loops, each with its own alarm and register, and in some cases to bring all the circuits together at a central office on to one multi-circuit register. By so doing the necessity of having separate registers at the central office with take-up reels and time stamps for every circuit is avoided and the cost is reduced.

The register, fig. 3, is an electro-mechanical device connected in the series circuit and so arranged that on the interruption of the current it punches a single hole in a paper tape and passes the tape forward at a uniform speed. Thus a break in the line will give a single hole in the tape as well as giving a single stroke on all gongs and alarm bells on the circuit. A proper call will, of course, result in a number of perforations, according to the code number of the calling alarm box; the code can be of two or three digits separated by a blank space. Low digits such as 1, 2 and 3, are generally used, with the result that a large number of boxes can be catered for without exceeding, say, five holes in the tape or five strokes on the gong, which means that the complete code will be received in about seven seconds. A special clock is used in connection with the time stamp. It is so arranged as to automatically take account of long and short months, and allows for the extra day in February of leap year. Where several circuits are connected to a multi-circuit register, the register perforates holes in a paper tape one or two inches wide, depending on the number of circuits involved. These registers are constructed to handle two, four, or six circuits. For the two-circuit register a one-inch tape is used, while for the others a tape two inches wide is employed in such a manner that the signals from each circuit appear on the tape side by side and have no mutual interference.

The "Gamewell" system is readily extensible, both with regard to the number of boxes connected into any loop and also the number of loops terminating at any station. The number of boxes connected into any loop can be increased up to the permissible limit without interrupting the normal working, and,

since no extra equipment is required at the station, the total additional expense associated with an extension is limited to the cost of supplying and erecting the new street boxes.

Fig. 5 shows the battery charging and control panel used for a small "Gamewell" fire-alarm system.

The "A.T.M." System.

The apparatus comprised in the system of summoning the fire brigade developed by the Automatic Telephone Manufacturing Co., Ltd., may be classified as follows:—

Street Fire-Alarm Box.—This, fig. 7, consists of clockwork mechanism, fig. 6, which controls a pair of impulse springs by means of a code wheel. The box is fitted with a lightning arrestor, test alarm key, signal key and telephone jack contained in an iron casing suitable for either wall or pedestal mounting. A door of the "break glass push button" type is used for releasing the mechanism, and can be supplied complete with a loud-sounding bell adjusted to come into operation as soon as the box is actuated. If telephone facilities (either police or ambulance) are desired, a standard Post Office instrument can be mounted at the back of the box.

Central Brigade Station Equipment.—This, fig. 8, comprises a switchboard on which are mounted all the battery-charging switches, line-test keys, telephone keys and lamps, measuring instruments, &c.; a telephone is provided for communicating with the street boxes, while in front of the panel are mounted a punching register, time and date stamp and paper take-up reel. At the top of the switchboard is a "visual indicator," and duplicate batteries are provided with specially designed charging switches which eliminate the possibility of even a momentary interruption in the current supply.

Circuit Operation.—A number of closed loops in which are included the street boxes and line relays, in series, are so arranged that when a street box is operated its mechanism (commencing to rotate) causes a series of breaks in one of the closed loops, and the register at the central station punches a series of holes in paper tape (corresponding to the code number of the particular box). Simultaneously the time and date stamp, controlled by the master clock, stamps on the tape the exact time of the call (minute, hour, a.m., or p.m., month and year).

When a street box is operated, its mechanism is released and the code wheel actuating the impulse springs gives rise to a series of alternate breaks and makes in the closed loop, the number depending on the disposition of the teeth on that particular code wheel. As soon as the loop is broken, the two line relays on that loop are released and cut in two holding relays. At the same time an alarm bell and two loop-indicator lamps are brought into operation, thus giving warning of a call and an indication of the loop affected. Moving in accordance with the impulses from the box, the armatures of the line relays transmit the call to the 2-circuit punching register associated with that loop and, at the same time, a single-stroke bell, working in conjunction with the punching register, beats out the number of the box.

Fault Rectification.—The A.T.M. system is said to provide for every eventuality calculated to derange the accurate functioning of such a vital service, and its self-testing features are

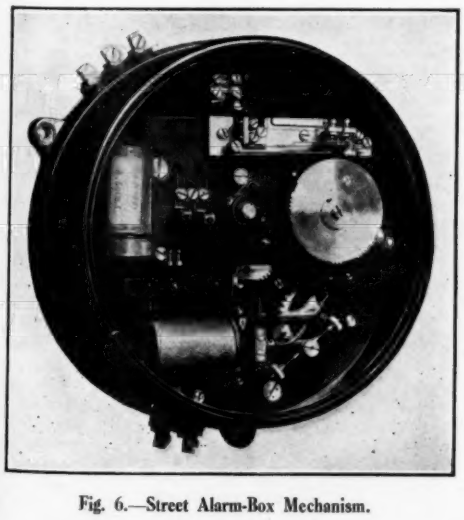


Fig. 6.—Street Alarm-Box Mechanism.

such that, should a wire break in a loop, the line relays will ring the alarm bell, light the signal lamp, and thus enable the attendant to throw over the "broken line switch," thereby restoring the system to temporary working order. Alternatively, should one end of the broken line become earthed, the associated line relay will restore the system to temporary working order. A visual supervisory indicator is incorporated in the system, consisting primarily of a glass panel divided into sections designated "Earth Fault," "Test and Telephone Call," "Line Break," "Press Restore Button," "Rewind Puncher," "Renew Paper Tape," "Two Simultaneous Calls." In the event of any of the above-named conditions arising, the corresponding panel will be illuminated and the alarm bell will ring to indicate what duties devolve upon the attendant.

At the conclusion of a fire call, when the loops are clear of faults, all the central-station apparatus automatically returns to normal in readiness for the next call. When two boxes on one loop are pulled simultaneously, the transmission of both calls is precisely as described, except that the punching register records both calls on the tape at the same time, without delay or mutilation. This is claimed to be an exclusive feature

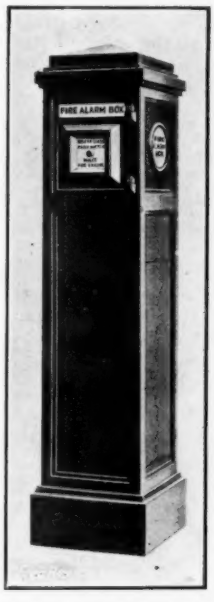


Fig. 7.—Street Fire-Alarm Pillar.

Fig. 8.—Fire-Brigade Station Equipment.

of the A.T.M. system and effects a saving of 21 seconds at the outbreak of a fire. This result is achieved by means of a safety contact in each box which earths the loop in accordance with the arrangement of the teeth in the code wheel. The centre point of the line battery is also earthed automatically, and so places a closed circuit *via* earth at the disposal of both boxes. Therefore, no matter how many alarm boxes are actuated at the same instant, a call is never lost nor mutilated. For example, if a second box is operated while one box is transmitting, the second call arrives at the fire station after the first has been completed. Furthermore, it is immaterial whether the second box is nearer to the station than the first one operated: there will be no confusion between the two sets of impulses, the second being held up until the first box operated has completed its call.

The circuits are so designed that the alarm bell can only be silenced by the attendant correctly responding to the luminous warning signals. If no attendant is on duty when a fault arises, it will in no way delay or mutilate a fire call; by throwing over the associated keys and pressing the restore button the attendant is only ensuring that all the apparatus returns to normal at the *conclusion* of a call. The actual time occupied in sending a complete signal is seven seconds, whilst the time interval between the signals which constitute a complete call is short also. Finally, the system is essentially flexible, so that, once installed, it will lend itself to indefinite expansion to meet the increasing requirements arising from the natural growth of cities and towns.

Volta Centennial Celebrations.

At the International Congress of Physicists which will be held at Como from September 11th to September 16th, this country's representatives will include the following authors of papers: Dr. F. W. Aston (on recent work with the mass-spectrograph); Prof. W. L. Bragg (on the diffraction of short electromagnetic waves by a crystal); Prof. A. S. Eddington (on electrical conditions in the deep interior of a star); Dr. J. A. Fleming (on the electric conductivity of dielectrics); Prof. O. W. Richardson (on the spectrum of the hydrogen molecule); and Sir Ernest Rutherford (on atomic nuclei and their transformations). It will be noticed that all of these papers deal with atomic subjects intimately associated with electrical science. Sir J. J. Thomson will also read a paper on a subject to be announced later. In all some 68 papers have been promised.

Electrical Development in Rural Areas.

A memorandum issued by the Electricity Commissioners, copies of which can be obtained free of charge from the Commission (Savoy Court, London, W.C.2).

THE attention of the Electricity Commissioners has been drawn from time to time by local authorities and companies alike to various difficulties which have been encountered in their efforts to establish or extend the supply of electricity in rural areas, and to factors which serve to impede developments of that character. More recently, important representations have been made to the Commissioners as to the need of making more widely known the principal considerations which govern the successful commercial development of rural supplies, with the object of enlisting the co-operation of all who are in a position to assist in facilitating such development.

The schemes which will be carried out by the new Central Electricity Board in due course will add substantially to the possibilities of transmitting supplies over wider areas than hitherto, and thus of establishing new distributing centres in areas where there is a reasonable demand for supplies. It appears therefore to the Commissioners that the moment is opportune for indicating the nature of some of the difficulties associated with the carrying of supplies into rural areas, and also the directions in which co-operation is essential if the benefits rendered possible by the recent legislation are to enure in proper measure to rural communities.

Costs of Distribution.

The costs of local transmission and distribution represent a substantial addition to the cost of producing electricity even in urban centres where the number of consumers obtainable per mile of cable laid is necessarily greater than can be the case in the sparsely populated rural areas. In order to enable supplies at a commercially remunerative price to be given in rural areas, every possible economy must be exercised in regard to capital expenditure on transmission and distribution.

Overhead and Underground Distribution.

Supplies must be given either by overhead lines or by underground mains, and there is a great disparity between the respective capital costs of such works. For example, the cost per mile of a medium voltage (400/230 volts) overhead distributing main ranges from £400 to £800 according to the size of conductor used, and hence the amount of energy that can be transmitted. On the other hand, the cost per mile in the case of corresponding underground cables ranges from £1,300 to £1,850. For high tension transmission, say, at 11,000 volts, the cost per mile for overhead lines would range from £500 to £900 according to the size of conductor, as compared with a range of from £2,600 to £2,700 for corresponding underground mains. The question whether the relative costs in favour of overhead lines in rural areas can be still further improved by permitting the use of shorter poles or otherwise has been raised and is under consideration.

The substantially higher cost of underground distribution interposes a serious and in many cases an absolute obstacle in the way of this method of electrical development in rural areas; and, in consequence, the liberal use of overhead lines, together with the best possible facilities for their erection, is essential if rural communities are to enjoy the benefits of a public supply of electricity.

Statutory Position.

Broadly speaking, no overhead line can be erected by an authorised electricity undertaker without the consent of the Minister of Transport. The local authority of the district concerned or the County Council in the case of county bridges or main roads, have no right of veto, but are entitled to an opportunity of being heard by the Minister in respect of any objections they have have to a proposed overhead line. It is the normal practice of the Minister to accord such hearing locally in the form of an inquiry.

It would greatly conduce to the more expeditious development of rural supplies if local authorities would adopt more widely the procedure already followed in some cases of giving a general approval to the erection of overhead lines in their district, leaving any question arising on specific works to be settled subsequently when the supply authority gives the necessary notice of intention to carry out such works.

The infrequency of the meetings of various local authorities at which such matters are considered has also proved a cause of delay in the past, and rural electrical development would be facilitated if such authorities could see their way to confer emergency powers on their chairman in respect of overhead line proposals with the view of facilitating the prompt settlement of such matters.

Local Objections and Difficulties.

While it is fully appreciated that due regard must be had to local amenities, it should also be recognised that an unyielding attitude on this ground may often mean the denial of a public utility service to the locality concerned. Local feeling against the use of overhead lines is often due to a failure to appreciate the economic aspects of rural supplies, and to the erroneous view that the community could equally well be served in all such cases if underground mains were employed instead.

Apart from the question of capital cost, there are technical objections to the employment of high-pressure lines which are partly overhead and partly underground, and also to abrupt deviations of the route of overhead lines. These factors may render it undesirable that portions of an overhead line *en route* to a particular locality should be deviated or replaced by underground sections.

Objection is sometimes raised on the ground that overhead lines will constitute a danger to the public, but practical experience has shown that the Overhead Line Regulations made by the Commissioners are fully adequate for securing the safety of the public. Accidents through the breakage of overhead lines or of the posts supporting them are of rare occurrence, only six cases of this kind having been reported to the Commissioners during the past seven years.

Wayleaves.

Owing to the general sparseness of load in rural areas, it is essential that overhead lines from centre to centre of population and branch lines to individual consumers should be run as direct as possible, and that unnecessary expense on circuitous routes should be avoided. The successful establishment of rural supplies on a more comprehensive scale than hitherto is therefore dependent to a large extent on the co-operation and goodwill of landowners in granting reasonable facilities for wayleaves.

The fact that the Minister of Transport can grant compulsory wayleaves and fix the terms and conditions thereof should not be regarded as absolving supply authorities from the endeavour to secure by negotiation such wayleaves as may prove necessary for the development of their undertakings, or from having due regard to the possibility of reasonable alternative routes and to the standpoint of the owners of land proposed to be crossed. Resort to the procedure laid down by statute for obtaining compulsory wayleaves without a reasonable effort to secure a settlement locally introduces an element of delay and must involve expense to all concerned.

On the other hand, the development of rural supplies is seriously retarded where owners of property fail to recognise that wayleaves are required primarily for public utility purposes, and that the withholding of facilities for wayleaves, or the practice of driving a hard bargain as if the granting of a wayleave were a matter for private advantage, may represent a disservice to the community. The action of an individual owner who stands out for better wayleave terms than those generally accepted by other owners in like circumstances may cause an important scheme of rural development to be held in abeyance, or may lead other owners who were previously prepared to accept a nominal rental to seek better terms also. These factors operate to raise generally the cost of or charges asked for wayleaves for overhead lines, and not only add to the difficulty of negotiating where many wayleaves are necessary along the route of a line, but also prejudicially affect the economy of prospective schemes of development.

For an overhead distribution line with spans of, say, 120 feet, a nominal rental of 1s. per pole for wayleaves represents an annual expense to the supply authority of £2 4s. per mile of line. Where the electrical development of a large area involves many miles of overhead distribution, and the use not only of single poles, but also of "A" or "H" poles or even tower poles with four legs, it is apparent that unless wayleave rentals per pole or per leg can be obtained at a low nominal charge, the incidence of such rentals must represent an appreciable addition to the cost of development, and consequently affect the price at which supplies of electricity might otherwise have been afforded to the communities concerned.

The varying circumstances of individual cases and the considerations which by statute must be taken into account in fixing terms and conditions for compulsory wayleaves prevent a rigid scale of wayleave rentals of general application from being officially prescribed. Nevertheless, a considerable measure of uniformity has already been attained in practice and could be more widely secured, to the advantage of electrical development, if the view were accepted that a public servitude such as a wayleave should in general be a matter for a nominal rental only.

Thus, a rental of 1s. per annum for a single pole has been largely accepted as a basic figure, and, in the view of the Commissioners (which cannot, of course, be held to limit the discretion of the Minister of Transport), wayleave rentals should not, save in exceptional circumstances, exceed from

1s. to 2s. 6d. for a single pole and *pro rata* for a double pole according to the nature of the land concerned and the use to which it is put.

It has been suggested that it would assist both supply authorities and land owners in negotiations for wayleaves if official recognition could be given to a model form of wayleave agreement suitable for the generality of cases, and steps are being taken to ascertain whether an agreed model form can be evolved.

Summary: Concluding Observations.

To sum up, the development of electricity in rural areas necessitates the fullest possible use of overhead lines and adequate facilities for wayleaves. The power of consent in these matters rests with the Minister of Transport, and it is not possible for a local authority to veto an overhead line proposal or for a landowner to exact a wayleave rental in excess of what is determined by the Minister to be reasonable.

Development would be expedited if local authorities adopted more widely the practice of giving general approval to the use of overhead lines, and of conferring emergency powers on their chairmen to ensure prompt settlement of questions arising in particular cases; and also if the view were more widely accepted by land owners that wayleaves for public utility purposes should in general be a matter for a nominal rental only.

The Commissioners recognise that the provision of such a public utility service as the supply of electricity by overhead lines cannot always be effected with no detraction whatever from local or private amenities, although precautions can often be taken which will tend to minimise any obtrusiveness of such lines except in open country. There is a growing public demand that supplies of electricity should be made available as speedily as possible in rural areas, but progressive development of this character will only be possible if a due balance is preserved between the claims of utility on the one hand and of amenity on the other.

The duty is placed upon the Commissioners of promoting the supply of electricity throughout the country, and they desire, in the interests of electrical development generally and of rural development in particular, to enlist the co-operation not only of supply authorities, but also of local authorities, communities and landowners in the preceding matters, and the active support of all who are in a position to afford facilities which will promote and expedite the development of rural supplies of electricity.

The Electrical Imports of Chile.

THE following figures, showing the values of the imports of electrical and allied goods into Chile in 1925 are taken from the recently published official trade returns. For purposes of comparison the figures for 1924 are given, and notes of increases or decreases are made:—

	1924. Thous. Pesos.	1925. Thous. Pesos.	Inc. or dec. Thous. Pesos.
Insulators for telegraphs and telephones, &c.—			
Total	328	156	− 172
From United States	154	71	− 83
,, Great Britain	64	22	− 42
,, Germany	104	62	− 42
Wire, insulated or sheathed (covered)—			
Total	448	742	+ 294
From Germany	256	419	+ 163
,, United States	105	207	+ 102
,, Belgium	2	12	+ 10
,, Great Britain	63	49	− 14
Incandescent electric lamp bulbs—			
Total	594	759	+ 165
From Germany	235	342	+ 107
,, United States	140	160	+ 20
,, Holland	170	156	− 14
,, Great Britain	34	33	− 1
Apparatus (various) for electric lighting—			
Total	957	570	− 387
From United States	558	202	− 356
,, Great Britain	44	91	+ 47
,, Germany	338	239	− 99
Telephone apparatus—			
Total	622	641	+ 19
From Great Britain	327	319	− 8
,, Germany	101	19	− 82
,, Belgium	11	10	− 1
,, United States	159	49	− 110
,, Sweden	19	231	+ 212
Telegraph apparatus—			
Total	102	95	− 7
From Germany	29	9	− 20
,, Argentina	4	2	− 2
,, United States	38	47	+ 9
,, Great Britain	27	36	+ 9
Wireless apparatus—			
Total	541	490	− 51
From Great Britain	16	19	+ 3
,, Germany	25	47	+ 22
,, United States	458	353	− 105
Electric cables—			
Total	1,621	1,778	+ 157
From Germany	307	300	− 7
,, United States	905	1,186	+ 281
,, Great Britain	407	272	− 135
Electric bells and parts thereof—			
Total	8	11	+ 3
From Germany	4	8	+ 4
,, United States	2	1	− 1
,, Great Britain	—	1	+ 1
Pipes and tubes, insulated for electrical purposes—			
Total	74	103	+ 29
From Germany	71	86	+ 15
,, United States	—	7	+ 7
,, Great Britain	1	2	+ 1
Carbons for electrical purposes—			
Total	44	44	—
From United States	23	7	− 16
,, Great Britain	17	29	+ 12
,, Germany	4	7	+ 3
Dynamos, motors and parts thereof—			
Total	2,572	2,082	− 490
From Germany	829	445	− 384
,, United States	848	814	− 34
,, Great Britain	827	744	− 83
,, France	12	23	+ 11
Electric lamps (other than incandescent bulbs)—			
Total	169	137	− 32
From Germany	86	77	− 9
,, United States	59	45	− 14
,, France	14	10	− 4
,, Great Britain	3	1	− 2
,, Holland	1	—	− 1
Meters—			
Total	270	215	− 55
From Germany	43	71	+ 28
,, United States	24	33	+ 9
,, Great Britain	152	108	− 44
Cells and accumulators—			
Total	375	418	+ 43
From Germany	84	100	+ 16
,, United States	188	256	+ 68
,, Great Britain	82	50	− 32
Posts for supporting electric wires and cables—			
Total	55	36	− 19
From United States	39	22	− 17
,, Great Britain	16	14	− 2
Electric fans—			
Total	9	46	+ 37
From Germany	3	14	+ 11
,, United States	1	24	+ 23
Electrical machinery, apparatus and parts (unspecified)—			
Total	3,530	2,221	−1,309
From United States	1,778	1,477	− 301
,, Germany	1,085	488	− 597
,, Great Britain	344	225	− 119

(Peso = 1s. 6d.)

Russian Electrical Developments.

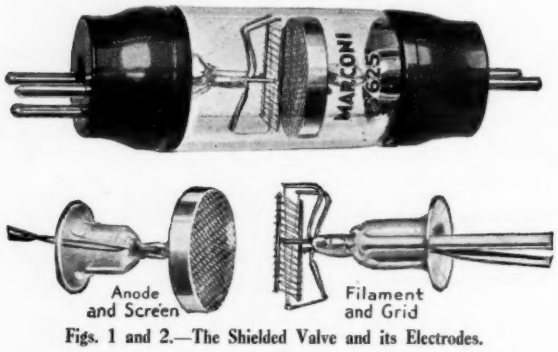
The largest turbine ever turned out in Russia, 10,000 kW, has, according to *Power*, been recently installed in the Petrovsky steel mill at Dniepropetovsk. It was constructed at the Leningrad works, where two 22,000-kW turbo-generators are to be built. The Amtorg Trading Corporation of New York announces that additional orders valued at $250,000 have been placed in the United States for electrical equipment for the 650,000-h.p. hydro-electric development on the Dnieper River.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

New Marconi Valves.

A new era in high-frequency amplification seems to have been inaugurated by the appearance of a shielded valve, type S.625. One of the greatest difficulties that confront the designer of a high-frequency amplifier is the problem of overcoming reaction effects due to the capacity between grid and anode of the valve employed. The most careful shielding of the components in these circuits is useless unless some form of neutralisation is adopted, and even then the fact that the neutralising condenser cannot have the same phase angle as the inter-electrode capacity makes perfect balance impossible. Furthermore, neutralisation is not effective except over a comparatively narrow band of frequencies, and requires re-adjustment as the tuning changes, if the set is to be maintained at its most sensitive stable working point. However, the problem may now be attacked in a fundamentally different manner, by overcoming the inter-electrode capacity effect within the valve itself, and thus making neutralisation unnecessary. In the S.625 valve a fine-mesh grid is interposed between the ordinary grid (which is of the standard Marconi type) and the anode (a flat circular plate with dished edges); the grid and filament are supported by, and connected to, a cap at one end of the glass tube and the anode and screening grid by a second cap at the opposite extremity, so that the "live" leads are as far apart as possible. The valve should preferably be mounted in a horizontal position in a special holder which incorporates a dividing partition, the grid and plate circuits being separated by copper screening boxes so arranged that the partition dividing them is in the plane of the screening grid, being cut away only just sufficiently to allow the glass bulb to pass through, figs. 1, 2 and 3. The partition should be earthed and the screening grid connected directly to a suitable point of the h.p. battery, say, 80 volts, so that a complete electrostatic screen is formed. Approximately 120 volts may then be applied to the anode through a suitable high-frequency transformer, or tuned-anode coupling. As the internal resistance of the valve is high, it is desirable to use "litz" wire for the shorter-wavelength (up to 600 metres) coils to obtain maximum impedance when tuned, and to reduce the losses to a minimum. However, when quite ordinary coils are used the results obtained should be superior to those given by neutralised circuits and ordinary valves. The best type of coil is the single-layer solenoid of 2 to 3 in. diameter for the broadcast band, and a pile-wound coil of similar size for the longer wavelengths, while (owing to the copper screens) it is advisable to use some kind of astatic, or "fieldless," winding to reduce eddy-current and reaction effects. Two simple circuit arrangements are shown in figs. 4 and 5, one for purity and the other for range. The Marconi S.625 valve thus brings amplification of 30-35 per stage within reach with stability and efficiency over a very wide range of wavelengths, and is an important step towards the realisation of reliable long-distance reception. A single stage presents no particular constructional difficulties, and once the general principles are mastered, a second and even a third may be added, when the sensitivity should, it is



Figs. 1 and 2.—The Shielded Valve and its Electrodes.

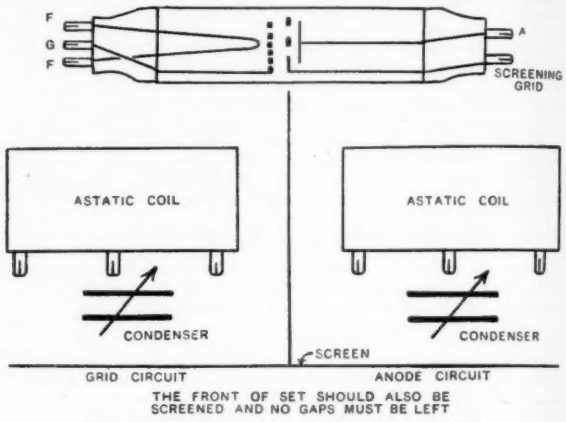


Fig. 3.—Arrangement of Screened Valve, Type S.625.

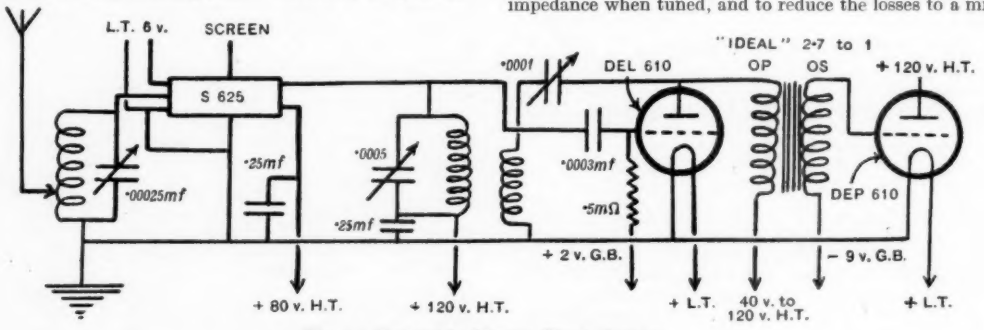


Fig. 4.—Good-quality Distance Circuit, Reactive.

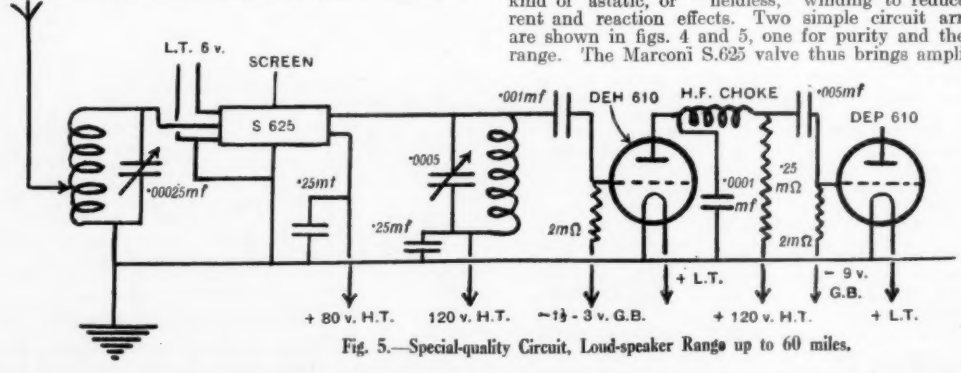


Fig. 5.—Special-quality Circuit, Loud-speaker Range up to 60 miles.

claimed, be on a par with that of the best super-heterodyne circuits. Since a considerable high-frequency input to the detector valve is obtainable with the aid of the new valve, anode-bend rectification may be used, a Marconi D.E.H. 610 resistance coupled to a D.E.L. or D.E.P. 610 being suitable. When greater range is required, reaction may be used and the detector valve should be of the Marconi D.E.L.610 type, followed by a 2.7 to 1 "Ideal" transformer and a D.E.P.610 valve. It will be found that in most cases only a single stage of low-frequency is required. The new valve's characteristic curve is reproduced in fig. 6; its filament voltage is 6.0 V and filament current 0.25 A. The magnification factor and impedance vary between wide limits with changes of voltage on the electrodes, but the values under a typical set of conditions are as follows:—Anode voltage 120 V, screening grid voltage 80 V, grid voltage 0 V, magnification factor 110, and impedance 175,000 ohms.

In the correspondence column of the *Morning Post*, Prof. J. A. Fleming, the inventor of the thermionic valve, recently referred to the remarkable properties of the double-grid valve* invented by Capt. H. J. Round in the following terms: "As one who has been permitted by his kindness to employ

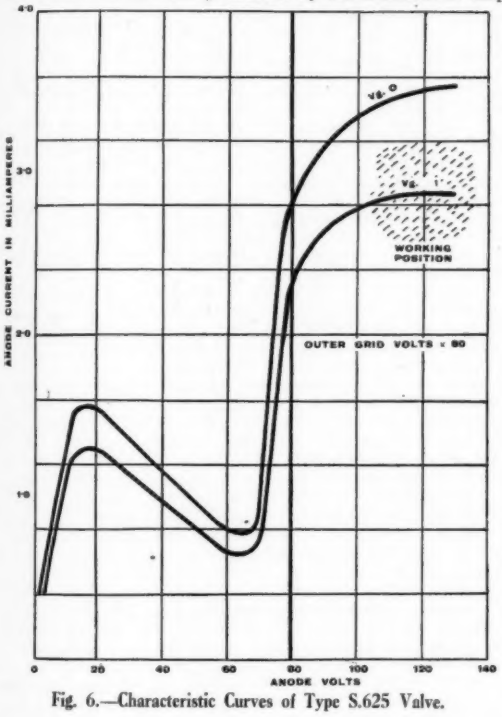


Fig. 6.—Characteristic Curves of Type S.625 Valve.

some of these valves for some time past, I can confirm what your correspondent claims for them. Using two of these new valves as radio-amplifiers, followed by a detector and two-note amplifiers of ordinary type, I receive on a small frame aerial at a distance of 170 to 240 miles Daventry (long-wave), Radio Paris, and other stations at very full loud-speaker strength and great purity, and speech is excellent.

"These valves will be a boon to dwellers in flats and places where an outside aerial is impossible, who yet wish to receive from long-distance stations loud-speaker music and speech. The advantage of being able to receive on an indoor frame aerial with a superfluity of power is very great, as it is sometimes possible then to reduce atmospherics, morse signals, or other interference by slightly turning the frame without much loss of loud-speaker strength.

"The absence of regenerative coupling in these new sets will be found to be a great general convenience, as inexpert users cannot then annoy others by creating howling."

[As we go to press we learn that an identical valve to the above, the Osram S.625, has been marketed by the General Electric Co., Ltd.]

A Piezo-selective Valve.

The LOEWE Co., the originator of the multi-stage thermionic valve in Germany, is reported to have produced another novel type, also of the multiple pattern. A piezo-electric crystal is so incorporated as to form one of the elements inside the bulb, with the object of preventing the valve responding to any but one frequency. In this manner when the crystal is ground to correspond to the wavelength of one particular transmitter, signals from that station only, to the exclusion of all others as well as interfering noises, can get through that particular valve.

* See Hull and Williams, *Physical Review*, April, 1926 (British Patents Nos. 230,011 and 255,441, theoretical only): also *Wireless World*, July 27th, 1927. The Schottky screened valve is also being developed by the General Electric Co. of America.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Rural Electric Lines.

With reference to the very interesting contribution from Mr. W. Fennell in your issue of August 26th, I should hate to daunt such a courageous engineer as he is, but I am afraid he is not correct in saying that the 1926 Act has added one other Authority, meaning the County Council, to those who have to be consulted in the matter.

Of course, it is quite true that the County Council has come in, but still another Authority has been introduced by Clause 44, Sub-Section 3, of this Act. This is the Commissioner of Works, who can make recommendations if the line interferes with ancient monuments. It is for this reason, I understand, that with the Form El.C. 34, which has to be sent in to the Commissioners with technical particulars of the line, a duplicate copy of the ordnance map must, in certain cases, be submitted.

While on the subject, I might also mention that there is a third Authority who, although not mentioned in any Act, still has very great powers and influence. I believe that for some reason or other it is not supposed to be politic to mention this third Authority, but no doubt Mr. Fennell and other engineers who have been putting up a considerable number of lines know what the third Authority is and how it comes into the matter.

J. M. Donaldson.

Chief Engineer, THE NORTH METROPOLITAN ELECTRIC POWER SUPPLY COMPANY.

London, *August 27th*, 1927.

Flameproof Mining Plant.

In your issue of August 12th, you give a *précis* of the third report of the Safety in Mines Research Board. An illustration therein, fig. 2, shows a type of vent recommended to meet the requirements of an efficient relief for flameproof apparatus.

It may interest you to know that this type of vent, in exact detail of construction, was designed by us and supplied on flameproof mining switchgear fourteen years ago. Since then, the design has been much improved (under our patent number 189,664), details of which were published in the *Mining Electrical Engineer*, December, 1925.

The Electric Construction Co., Ltd.,
W. M. FURNISS, *Director and Manager.*

Wolverhampton, *August 24th*, 1927.

A Two-rate Meter.

Now that meters of at least 10-ampere capacity are obtainable with an accuracy equal to that of 2½ or 5-ampere meters specially wound for these sizes, it occurs to me that if a device were designed—possibly in the nature of a relay—to automatically alter the rate of recording according to the load, it would be a boon to small undertakings, to which the provision of two meters for each consumer using both light and power is a serious matter from the financial point of view. I suggest that where a consumer having, say, 10 lamps also uses power, he should have a reduced rate for all units used beyond a certain quantity, this rate, however, not to be governed by the actual number of units used, but by the load. Assume each of the 10 lamps to be of 40 watts, giving a maximum lighting load of 400 watts, then the device would be set to operate at 400 or 450 watts and would bring into circuit another device—electrical, magnetic, or mechanical, as might be found most effective—that would regulate the meter speed in such a way that it would record the units used on all loads above 400 or 450 watts at a rate calculated to suit the reduced price per unit. The relay, or whatever device were used, would require to be variable so that the point of cut-in could be altered to suit the number of lights installed, and the device could be tested and set on the actual load by the meter fixer.

Someone may say that a similar result may be obtained by means of a time switch or by a tariff based on ratable value or so much per lamp, but my idea is that a time switch is even less desirable than a second meter, and that consumers are apt to be suspicious of tariffs where they have to pay a fixed sum, even if they consume no units, while most consumers could see the advantage of a tariff giving a certain reduction if good use is made of the supply.

In addition to other advantages, such an arrangement as is suggested above would save office work, as there would be only one set of figures to work out for each consumer.

Perhaps some manufacturer will say if such an arrangement is practicable; and if not, what are the objections to it.

Simplicity.

August 24th, 1927.

Domestic Water Heating.

In Mr. Parker's most interesting account of the success achieved at West Hartlepool in obtaining a useful increase in domestic load by hiring out electric water heaters, many supply engineers will find, it is hoped, the encouragement which they need to go and do likewise. They will profit, too, by his word of warning against the dangers of allowing consumers to be misled by ignorant advice into faulty adaptation of existing fuel-heated water systems. Nothing can do more harm to this line of electrical progress than the haphazard introduction of immersion electric heaters into badly lagged or wholly unlagged existing tanks, with their extravagant radiation losses.

Mr. Parker is inclined to discourage the use of tanks having a capacity larger than 11 gallons, but it must be borne in mind that if the tank capacity is insufficient to afford liberal supplies of hot water for the household, the criticism which arises is likely to fall upon the electric system of heating. There is much to be said in favour of a tank of ample storage capacity for the requirements of the whole day, with its heating elements dimensioned to suit the daily loading period fixed by the supply authority.

The large tank yields a better thermal efficiency, and, most important of all, presents the best means of utilising the electric heating of water for improvement of load factor.

For a steady off-peak load during the night hours, say, from 11 p.m. to 7 a.m., a large tank having its thermostat control combined with a time switch is ideal, whilst, as an alternative to this, the large tank can be made to effect a wonderful improvement in load factor by combining its thermostat control with a load-levelling relay, which makes the supply of current to the heater available only when the demand from other equipment in the house is below a predetermined figure. The water-heating load then serves to fill up the depression in the load curve of each individual house.

Electric generating authorities could well afford more generally to offer prospective users of thermal storage tanks the attractive inducement of a specially reduced tariff during the night time, and some distributing authorities who buy their supplies in bulk at a flat unit rate could present to their suppliers a very strong argument in favour of a reduced tariff such as would enable them to make the most of the loading possibilities of domestic water heating.

As to the future, it is most earnestly to be hoped that the Central Electricity Board will see its way, as suggested in your own editorial comments on Mr. Parker's article, to frame a special night tariff similar to what has already been adopted by existing undertakings. If such a tariff is economically sound for the individual generating authorities, it is equally sound for the Board, and it would unquestionably present a sure means of improving the load factor of the country's demand on the "grid."

Ferranti, Ltd.
(R. J. HEBBERT.)

Hollinwood, *August 29th*, 1927.

[In connection with this important matter it is interesting to note that in the Report of the Advisory Committee on Domestic Supplies, attention was drawn to the form of tariff in the following terms (p. 11):—

"The supply of electricity in bulk to authorised distributors will become a feature of increasing importance, and, apart from the obvious necessity that such supplies should be provided cheaply, it is essential that the *form of tariff* for bulk supplies should be such as to make it possible for the distributor to obtain the diversified load upon which the financial success of a bulk supply depends. Bulk supply tariffs, often the subject of long term contracts, are usually in multipart form, consisting of a kilowatt demand charge and a unit charge, and with or without sliding scales covering the cost of fuel and/or other items. It is apparent, however, that in some cases these tariffs do not allow the distributor to re-sell at sufficiently low rates to secure certain classes of business, owing to the unit rate being higher and the maximum demand rate lower than they need be, or to the method or form of the bulk supply charge possessing more rigidity than it is possible for the distributor to secure in his retail transactions with consumers."

Here again, therefore, this valuable report looked into the future and foresaw the difficulty which Mr. J. H. Parker has brought into prominence in our pages. The views of managers interested in the subject—as bulk supply authorities on the one hand and as retail distributors on the other—would be welcomed.—EDS. ELEC. REV.]

Electric Train-lighting.

Out of the disastrous accident on the Southern Railway which took place last week one consoling fact emerges—the wrecked coaches did not catch fire. Had they done so, the frightfulness of an already appalling crash would have been greatly intensified. But, as a railway foreman remarked to a correspondent of *The Times*, "There was no danger of fire because the coaches were electrically lit."

Reviews.

Electric Trains. By R. E. DICKINSON, B.Sc. (Eng.) Lond., A.M.I.C.E., A.M.I.E.E. Pp. xii+292; figs. 138. London: Edward Arnold & Co. Price 16s. net.

The author of this work is Works Manager of the electric train repair shops of the New South Wales Government Railways, Sydney, and was formerly Assistant Trains Engineer on the London lines of the L.M.S. Railway.

The book is primarily addressed to the railway engineer who is supposed not to possess an adequate knowledge of mathematics and whose business is the running and maintenance of trains. It deals with the apparatus and devices in use on electric trains, and with some convenient methods of making calculations in practical working. The mathematical portions have been written as simply as possible for the benefit of the *student* (who, by-the-by, is assumed to be familiar with the use of the planimeter).

The elementary mechanics of train movement is treated in the first two chapters and numerical examples are worked out for so-called "run curves," which involve simply the calculation of distance and average speed when the acceleration, the coasting and braking retardations, and the times of these periods are given. The converse problem—*viz.*, the calculation of the acceleration necessary to run a given service—is not tackled, although its solution would have involved only simple mathematics.

The elements of series-parallel control are explained in Chapter 3, and the remainder of the chapter is devoted to the computation of speed-time curves from given data of the route and train equipment. Two examples are worked through—one for level track and the other for graded track—and in each case a constant value has been assumed for train resistance. The speed-curve-running portion of the speed-time curve is determined by the usual point-to-point method, but, for the simplest case of a run on level track with constant train resistance, a process of trial and error is adopted for determining the points of cut-off and application of brakes, although for the conditions assumed, these points can be calculated with precision by the application of elementary dynamics.

Chapter 4 is devoted principally to a detailed consideration of the Oerlikon multiple-unit control system as installed on the Euston-Watford trains. The chief features of other multiple-unit systems are also considered.

Rheostat calculations are tackled in Chapter 5, but the author's efforts do not rise above trial-and-error methods. At first sight the chapter appears to be pretentious, as it contains considerable tabular matter relating to the calculation of "notching" curves. A detailed examination, however, discloses the fact that it contains very little that is of real value in the calculation of rheostats. For example, having given the speed-current curves and other data of the motors, the number of steps in the controller, and the average value of current during the starting period the author assumes *both* upper and lower limits for the current and proceeds to determine the resistance steps for these conditions by calculating and plotting speed-current curves for each rheostatic step. The correctness of the assumptions for the limits of the current is not known until the speed-current curve for the last section of resistance has been calculated, so that new limits of current may have to be assumed and new speed-current curves calculated until the desired result is obtained. In defence of his method the author states that—"it has the merit of being derived from first principles . . . . and is the method invariably used by the large manufacturing companies." The reviewer disagrees entirely. No doubt such time-consuming trial-and-error methods may have been used during the last decade, but no manufacturing company could afford to use them at the present day when a number of exact methods (which are also derived from first principles) are available. The author will find one of these given in Carter's *Electric Railway Traction* (with which, apparently, he is familiar, as 13 diagrams are taken therefrom) and others in the *Journal of the Institution of Electrical Engineers* (Vol. 58, p. 645—"Analytical Determination of the Steps in the Starter of a Series Motor," by Dr. S. P. Smith; Vol. 60, p. 837—"A Universal Chart Method of Calculating Starting Rheostats," by A. T. Dover). Later in the chapter a graphical trial-and-error method is described, but no mention is made of the difficulties involved in obtaining accuracy with this particular graphical method.

Direct-current traction motors are discussed briefly in Chapter 6, and current collection is well done in Chapter 7.

Chapter 8 deals briefly with single-phase motors and still more briefly with control. An attempt is made to explain the theory of five types of motors in 15 pages (inclusive of diagrams), and the control of these motors in 5 pages!

The following chapter is even more remarkable, as three-phase traction systems, motors, speed control, and the split-phase system are condensed into 8½ pages!

Chapter 10 deals with brakes, and is the best chapter in the book. Good explanations and diagrams are given of the working of the Westinghouse, vacuum, and electropneumatic brakes and the calculation of brake rigging.

Three short chapters then follow in which are treated train resistance, motor performance and rating, regeneration,

and a comparison of direct-current, single-phase and other systems of electrification. We notice on page 262 that a form of emergency rheostatic braking is incorrectly described as regenerative braking.

The last chapter is a good one and should be very useful to railway engineers. It gives an example of the complete calculation of the speed-time curve and energy consumption for a train under actual service conditions.

The book should prove useful to engineers and others concerned with the running of electric trains, but the student and railway engineer will require something more comprehensive. We should have liked to see chapters on the maintenance of the electrical equipment, repair shops, and inspection routine. The author's style is at times not all that could be desired and his treatment lacks originality: in fact many sections of the book closely resemble sections of well-known books on electric traction, and a number of diagrams have obviously been taken from the latter. There are some discrepancies in the symbols, but the misprints are few. The line illustrations are clear, and the printing and binding are excellent.

A **Manual of Automatic Telephony.** By CHARLES W. WILMAN, A.M.I.E.E., Pp. i—vi+223, 76 illustrations. London: Crosby Lockwood & Son. Price 7s. 6d. net.

This handy little volume has been prepared by the author from the lecture notes on automatic telephony which he employed in the preparation of students for the final examination in telephony of the City & Guilds of London Institute at the Coventry Technical Institute. Although no claim is made to provide detailed descriptions of the various systems in use, examples are given of the application of the general principles underlying the problems of modern practice, special attention being given to the step-by-step systems adopted by the British Post Office.

There are, in all, twenty-two chapters in which the student is led up from the fundamental principles through the various types of selectors, exchange connections, party lines, private automatic exchanges, exchange equipment, &c., to descriptions of the Director and Controller systems. The author does not hesitate in the course of his explanations to draw comparisons between systems by pointing out their relative advantages and disadvantages in a manner that will be distinctly helpful to an examinee who may be confronted with this frequent type of question. The book, which is freely interspersed with diagrams illustrative of the text—the circuit diagrams being drawn on the detached contact principle—may be safely recommended to those students who are preparing themselves for the examination already referred to.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1926.

2,296. "Electric signalling systems." Schneider et Cie. March 20th, 1925. (Addition to 245,761.) (249,478.)

2,451. "Wireless distant control system." Soc. Leroy, Lajoux & Cie. February 5th, 1925. (247,175.)

9,414. "Variable electrical condensers." Dubilier Condenser Co. (1925). Ltd. May 12th, 1925. (252,132.)

9,511. "Means for preventing electrical resistances from being overheated." Rheostatic Co., Ltd., and L. Satchwell. April 10th, 1926. (275,293.)

11,365. "Dielectric coverings for electric wires, cables, and the like." P. Allman, H. N. Morris, and L. H. Marlor. April 30th, 1926. (275,304.)

11,643. "Electric switches suitable for use as anti-theft devices for motor vehicles." A. C. King and J. Stringer. May 3rd, 1926. (275,317.)

11,644. "Apparatus for maintaining rotating bodies in synchronism for television and like purposes." J. L. Baird and Television, Ltd. May 3rd, 1926. (275,318.)

11,670. "Compound conductors for electric overhead lines." E. C. R. Marks. (Felten & Guilleaume Carlswerk Akt. Ges.). May 3rd, 1926. (275,322.)

11,727. "Automatic cut-out devices for ignition systems for internal-combustion engines." J. R. Hayes. May 4th, 1926. (275,324.)

11,730. "Machines for removing coverings from wire." Automatic Telephone Manufacturing Co., Ltd., F. Battisto, E. E. Comfort, and S. Hobson. May 4th, 1926. (275,325.)

11,822. "Thermionic valves." H. J. Round. May 5th, 1926. (275,335.)

11,859. "Control of electrical circuits." General Electric Co., Ltd., A. Kinnes, and M. S. H. Hunt. May 6th, 1926. (275,337.)

11,981. "Telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. May 7th, 1926. (275,343.)

12,192. "Processes for producing metals in electric furnaces." E. G. T. Gustafsson. May 16th, 1925. (252,162.)

12,366. "Electric switches." J. B. Tucker. May 13th, 1926. (275,346.)

13,365. "Anode." E. C. R. Marks (A. P. Munning & Co.). May 26th, 1926. (275,359.)

13,420. "Electromagnetic massaging and electrifying apparatus." G. R. Hoare, H. J. Hoare, J. C. Gibson, D. E. F. Hoare, and F. Sanna. May 27th, 1926. (275,360.)

13,703. "Automatic safety devices for electric circuits." J. Jones and J. Entwistle. May 31st, 1926. (275,362.)

14,935. "Armature bindings and the like." H. K. Whitehorn and Tilling-Stevens Motors, Ltd. June 14th, 1926. (275,376.)

15,214. "Combined automatic switches and voltage regulators." R. Bosch Akt. Ges. September 11th, 1925. (258,223.)

15,511. "Thermal circuit controller." J. Grigas. July 8th, 1925. (255,040.)

16,640. "Wireless receiving circuits." A. J. Garrod. July 2nd, 1926. (275,387.)

16,641. "Thermionic valve circuits." A. J. Garrod. July 2nd, 1926. (275,388.)

16,957. "Control switch for use with wireless apparatus." R. S. Bunting and E. A. Taylor. July 7th, 1926. (275,390.)

17,019. "Galvanic cells." C. F. Burgess Laboratories, Inc. July 7th, 1925. (255,067.)

17,020. "Accumulator plates." W Haddon and J. M. Burnett. July 7th 1926. (275,392.)

17,720. "Movable electric dash-light for motor-cars." B. Preston. July 15th, 1926. (275,398.)

17,744. "Electrical measuring instruments." S. Sokal (G. Wohlmuth and Co., Akt. Ges.). July 15th, 1926. (275,399.)

18,014. "Electric resistance furnaces." F. Krupp Akt. Ges. September 4th, 1925. (257,896.)

19,045. "Automatic pre-payment meters." Allgemeine Elektricitäts-Ges. July 31st, 1925. (256,259.)

19,816. "Galvanic batteries." Oldham & Son, Ltd., and G. L. Darby. August 11th, 1926. (275,418.)

21,012. "Electric light fittings of the candle type." J. F. Smith. August 26th, 1926. (Cognate application 24,375/26.) (275,424.)

22,950. "Electric socket or coupling elements." General Electric Co., Ltd., and R. J. Kaula. September 17th, 1926. (275,435.)

22,977. "Fuse for electrically-heated articles." W. Werner. September 17th, 1926. (275,436.)

22,994. "Electrical deposition of organic materials." Kodak, Ltd. April 1st, 1926. (268,717.)

24,437. "Electrodes for vacuum discharge vessels." Siemens-Schuckertwerke Akt. Ges. October 3rd. 1925. (259,242.)

26,621. "Regulators for electric machines or circuits." British Thomson-Houston Co., Ltd. October 28th, 1925. (260,587.)

26,913. "Incandescent cathodes." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 27th, 1926. (Addition to 274,981.) (275,449.)

27,035. "Means for mounting piezo-electric crystals." Marconi's Wireless Telegraph Co., Ltd. October 29th, 1925. (260,609.)

28,503. "Devices for eliminating microphonic noises in electron tubes." Federal Telegraph Co. May 25th, 1926. (271,808.)

28,771. "Gaseous discharge devices." Raytheon Manufacturing Co. December 21st, 1925. (263,111.)

29,755. "Thermionic valve generators and circuit arrangements therefor." Soc. Française Radio Electrique. November 25th, 1925. (Addition to 256,653.) (262,115.)

31,991. "Electrical transformers." British Electric Transformer Co., Ltd., and J. Roothaan. December 17th, 1926. (275,471.)

32,467. "Means for removing tape from insulated cables and for like purposes." H. G. Bennett and Trafalgar Engineering Co., Ltd. December 22nd, 1926. (275,472.)

1927.

236. "Sparking-plugs for internal-combustion engines." R. Colin. January 4th, 1926. (263,883.)

528. "Electrical operation and control of metal cutting and like machine tools." J. C. Shaw and R. D. Shaw. January 7th, 1927. (275,479.)

1,616. "Headlamps for mechanically-propelled vehicles." F. Gehrcke. February 1st, 1926. (265,182.)

2,292. "Radiators for electric transformer and like casings or tanks." British Thomson-Houston Co., Ltd. January 28th, 1926. (265,201.)

3,312. "Thermionic valve circuits." Telefunken Ges. für Drahtlose Telegraphie. February 6th, 1926. (265,612.)

3,919. "Carrying boxes for accumulators." C. Pfalzgraf. February 13th, 1926. (265,991.)

4,227. "Electric control systems for transmitting movements synchronously." E. Granat and Compagnie des Forges and Acieries de la Marine and d'Homecourt. September 28th, 1926. (Addition to 267,100.) (275,495.)

4,482. "Headlights." W. D'A. Ryan. February 17th, 1926. (266,362.)

7,553. "Vacuum tubes." British Thomson-Houston Co., Ltd. March 26th, 1926. (268,334.)

8,925. "Short-wave radio transmitters." C. Lorenz Akt. Ges. April 16th, 1926. (269,515.)

10,063. "Radio transmission systems." C. Lorenz Akt. Ges. April 29th, 1926. (270,273.)

10,302. "Coating of articles with metal in vacuum by electrode dispersion." W. A. F. Pfanhauser. April 14th, 1927. (275,523.)

11,498. "Safety arrangements for Röntgen apparatus." W. Otto. April 30th, 1926. (270,327.)

12,080. "High-frequency signalling systems." British Thomson-Houston Co., Ltd. May 5th, 1926. (270,734.)

12,408. "Electric incandescent lamp." R. P. A. Andersson. May 9th, 1927. (275,532.)

14,647. "Armouring of joints and coil-boxes in submarine cables." Siemens-Schuckertwerke Ges. June 11th, 1926. (272,487.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 24th. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Voltex. No. 477,056. Class 6. Magnetos and parts thereof. Société des Magnetos R.B., Paris. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Purcar. No. 479,975. Class 6. Electric vacuum cleaners and floor waxers and polishers.—Markt & Co. (London), Ltd., 98-100, Clerkenwell Road, E.C.1.

G.S. (lettering and design). No. 479,441. Class 6. Electrical machines. No. 479,442. Class 13. Electrical accessories.—Gebruder Siemens Gesellschaft, Lichtenberg, Berlin. (Haseltine, Lake & Co., 28, Southampton Buildings, W.C.2.)

Juventa. No. 479,477. Class 8. Radio-telephonic apparatus and electrical batteries (not for medical purposes).—J. C. Carstens, trading as J. Carstens and Co., Hamburg. (Arthur James, 12, Holborn Viaduct, E.C.1.)

Synchrodyne. No. 480,347. Class 8. Receiving apparatus for radio-telegraphy and telephony.—Lucien Levy, Paris. (J. E. Raworth & Co., 75, Victoria Street, S.W.1.)

Crystaframe. No. 480,391. Class 8. Apparatus for use in radio-telegraphy and telephony.—S. G. Brown, Ltd.

E.E. (lettering and design). No. 482,439. All goods in Class 8. No. 482,440. All goods in Class 13.—English Electric Co., Ltd., W.C.2.

Metesco (lettering and design). No. 481,122. Metal goods in Class 13.—Metropolitan Electric Supply Co., Ltd.

Diol. No. 481,770. Class 50. Insulating oils.—Standard Oil Co., New Jersey, U.S.A. (D. Young & Co., 11-12, Southampton Buildings, W.C.2.)

Glypmica. No. 482,416. Class 50. Electrical insulating materials.—Micanite and Insulators Co., Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ADDISCOMBE.—Automatic telephone exchange, Teevan Road; Post Office authorities.

ASHFORD (KENT).—Waterworks pumping station (electrical pumps), for the U.D.C.; surveyor.

AUDENSHAW.—School clinic; Lancashire Education Committee.

AYLESHAM (KENT).—Business stores for the River and District Co-operative Society, Dover; Mr. Evans, secretary.

BARNSLEY.—Conservative Club, new premises; N. A. Whitham, architect, 10, Regent Street.

BENTLEY-WITH-ARKSEY (NEAR DONCASTER).—144 houses; P. C. Woodhall, architect, Council Offices. Electric wiring, tubing, and fitting for 144 houses; tenders to F. Allen, Clerk to Council.

BERWICK-ON-TWEED.—Palais de Danse, Spittall; the proprietors.

BOURNEMOUTH.—Development, Brightlands estate; A. C. Hunter. Pavilion, Malvern Road; borough engineer. Elementary school, Charminster; Hawkins Bros. Club premises, Stamford Road; Southbourne British Legion Club. Shops and business premises, Richmond Hill; Montague Burton, Ltd. Additions, High School for Girls, Norwich Avenue; governors. Church, Heron Court Road; trustees. Shops and flats, Wimborne Road; S. Brown.

BRIERLEY HILL.—Elementary school; Staffs. Education Committee.

BRIGHTON.—Factory, Lewes Road, for Arthur H. Cox and Co., manufacturing chemists (several thousand pounds).

CHESHAM (BUCKS.).—Housing scheme (100), Pound Park estate, for the U.D.C.; A. Clarke, architect, Addison Road.

CHESTERFIELD.—Housing scheme (75), for the T.C.; architects, Wilcockson & Cutts (for 32), Saltergate, and Clayton & Rignall (for 43), Corporation Street.

CHESTER-LE-STREET.—Elementary school, Bullion Lane; Durham County Education Committee.

CHORLEY.—Premises, Pilling Lane; Chorley Co-operative Society, Ltd.

EDINBURGH.—Additions for Astley-Ainslie Institution, Morningside; the superintendent. Convalescent home at Gilmerton (£18,000) for Royal Infirmary; the medical superintendent.

EXETER.—Housing scheme (100), Pinhoe, for St. Thomas R.D.C.; H. C. Mildon, clerk.

FALKIRK.—Motor service station; Messrs. Wilson, Marshall and Sons, 'bus proprietors, Avonbridge.

FEATHERSTONE.—Elementary school; Staffordshire Education Committee.

FESTINIOG.—County School extensions; Merioneth Education Committee.

GLASGOW.—Rehousing at Haghill (594); housing director.

HADDENHAM (BUCKS.).—Electric light installation, Parish Church, for the Parochial Church Council; secretary.

HAMILTON.—Motor garage and showroom (£5,000), for A. and D. Fraser, Glasgow; the manager.

HINDLEY.—Extensions, Grammar School; governors.

HUDDERSFIELD.—Additional 70 houses, St. Andrew's Road, for the T.C.; borough surveyor.

INVERNESS.—Housing scheme (60), with electrical work, for the T.C.; Ballantyne & Taylor, architects, 28, Queen's Gate.

IPSWICH.—Extensions, East Suffolk County Offices; W. C. Reade, Aldeburgh.

IRISH FREE STATE (MONKSTOWN, Co. DUBLIN).—Electric lighting, St. John's Church; Rev. C. Dowse, rector.
(DUBLIN).—Housing schemes (£20,000), for the City Commissioners.

KEDINGTON.—Extensions, Mental Institution; East Suffolk C.C.

KILLARNEY.—Technical school; J. Gallwan, architect.

LINTHWAITE.—Middle school; Lancashire Education Committee.

LIVERPOOL.—350 houses; city engineer.

LLANDUDNO.—23 houses, Trinity Street; W. Dobinson and Son.

LONDON (STEPNEY, E.).—200 houses; borough engineer.
(WEST HAM, E.).—Extensions, Goodmayes mental hospital, for the T.C.; borough engineer.
(FULHAM, S.W.).—Machine shop, Willow Bank Wharf; Fennings & Co.
(CHELSEA, S.W.).—Tenements, Winsetts nursery site; Guinness Trust.

LONGTON (STAFFS.).—Re-erection of Alexandra Picture House, Edensor Road (electrically equipped), for Mrs. Grice; Harry Grice, manager (several thousand pounds).

MALMESBURY.—Electric light installation, Institution, for the B.G.; M. H. Chubb, clerk.

MARGATE.—Greyhound racing track, with electrical equipment, Hartsdown Estate (£20,000); H. J. Iles, managing director of Dreamland, Ltd.

MOTHERWELL.—Pit-head baths (£8,000), Broomside Colliery, for the Glasgow Iron and Steel Co., Ltd.

MYTHOLMROYD (YORKS.).—Houses (42), Stocks Estate; Addison & Sutcliffe, architects.

NEWCASTLE-ON-TYNE.—Telephone exchange, Newcastle East; H.M. Office of Works, Westgate Road.

NEWTON-IN-MAKERFIELD.—Electric light at Technical School; Lancashire Education Committee.

NORMANS RIDING.—Hospital; Blaydon, Ryton and Whickham Joint Hospital Committee.

NORTHERN IRELAND (BELFAST).—Improvements to Albert Quay (£20,000); Belfast Harbour Board.
(LURGAN).—Technical school, William Street; J. Johnston.

NORTH WALSHAM.—Extensions, Paston Grammar School; governors.

NORWICH.—Extensions, County Offices, Thorpe Road; Norfolk county surveyor.

OAKENGATES (SALOP).—Waterworks pumping station, &c., for the U.D.C.; John Taylor & Sons, engineers, Caxton House, Westminster, S.W.1.

OLDHAM.—Sunday schools, Glodwick (£5,300); Taylor, Roberts & Bowman, architects.

REDRUTH.—Housing scheme (50), for the U.D.C.; L. Winn, architect.

REIGATE.—Housing scheme (26), Smoke Lane, for the T.C.; Fred T. Clayton, borough surveyor.

RYTON.—Elementary school, Woodside; Durham County Education Committee.

ST. ALBANS.—Central school; Herts. Education Committee.

SALFORD.—Elementary school; R. S. Martin, secretary, Education Offices, Chapel Street.

SANDOWN (ISLE OF WIGHT).—Cinema, Albert Road, for A. Hill, Ryde.

SKEGNESS.—Shelter, welfare clinic, shops, offices, &c. (£4,000), for the U.D.C.; surveyor.

SOUTHWOLD.—Improvements, Southwold Cinema; licensee.

SOWERBY.—50 houses on Beechwood Estate; J. Eastwood, Council surveyor.

STONE (STAFFS.).—Heating, hot water service and laundry equipment, Yarnfield isolation hospital, for the Joint Hospital Board; Edwards & Shaw, consulting engineers, 105, Colmore Row, Birmingham.

SUNDERLAND.—238 houses; borough engineer.

TYLDESLEY.—Electric light, Technical School; Lancashire Education Committee.

WALKDEN (MANCHESTER).—Laundry, electrically equipped, for Mrs. Bushell (£5,000).

WARSOP (NOTTS.).—Church, Eastlands Terrace, for the United Methodist trustees; secretary.

WELWYN GARDEN CITY.—School; Herts. County surveyor.

WEMBLEY.—76 houses, Christchurch Estate; U.D.C. surveyor.

WEST RIDING.—School and caretaker's house, at Hirst Courtney and Temple Hirst. Infants' block at South Kirkby new school; Education Department, County Hall, Wakefield.

WIGAN.—Elementary school, Leader Street; Education Committee.

WREXHAM.—100 houses; R.D.C. surveyor.

YORK.—Extension, 'bus garage, Piccadilly, for Corporation Tramways Department; F. W. Spurr, city engineer, Guildhall.